Renewable Arizona: Restoration Design Energy Project

Draft Environmental Impact Statement

Volume I of II



February 2012

BLM

Arizona State Office







MISSION STATEMENT

"To sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations."

BLM/AZ/PL-12/004

DES 12-4

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Arizona State Office
One North Central Avenue, Suite 800
Phoenix, Arizona 85004-4427
www.blm.gov/az/
February 7, 2012

In Reply Refer To:
1677 (9100)

Dear Reader:

Attached for your review and comment is the Draft Environmental Impact Statement (EIS) for the Restoration Design Energy Project (RDEP). This document was prepared by the Bureau of Land Management (BLM) in consultation and cooperation with cooperating agencies and in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended; the Council on Environmental Quality and the Department of the Interior (DOI) regulations implementing NEPA (40 CFR Parts 1500-1508, 43 CFR Part 46), and the Federal Land Policy and Management Act of 1976, as amended.

The purpose of the RDEP is to amend BLM land use plans to identify lands across Arizona that may be suitable for renewable energy development and to establish a baseline set of environmental protection measures for such projects. The BLM is proposing to identify Renewable Energy Development Areas that may be suitable for the development of utility- or distributed-scale solar and wind facilities, as well as one Solar Energy Zone for utility-scale (greater than 20 megawatts) solar development. Additionally, the RDEP will identify design features, best management practices, and mitigation measures that will serve to guide renewable energy development on public lands in Arizona in an environmentally responsible manner.

The Draft EIS assesses the environmental, social, and economic impacts associated with the RDEP. The BLM encourages the public to provide information and comments pertaining to the analysis presented in the Draft EIS. You may submit comments by any of the following methods:

- E-mail: az_arra_rdep@blm.gov
- Fax: Attn: Lane Cowger, (602) 417-9454; and
- Mail or other delivery service: BLM-Arizona State Office, Attn: Restoration Design Energy Project, One North Central Avenue, Suite 800, Phoenix, AZ 85004-4427.

Your timely review and comments will be critical to the success of this effort and in preparation of the Final EIS. Comments will be accepted for ninety (90) calendar days following the date the Environmental Protection Agency publishes its Notice of Availability in the *Federal Register*. Comments received after the end of the review period will be considered to the extent practicable. We request that your comments be as specific as possible. Comments are more helpful if they reference a section or page number and include suggested changes, additional information sources, or alternative methods.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

To further provide information on the Draft EIS and to solicit written and verbal comments, the BLM will host five open house public meetings. The meetings will be from 6:30 PM to 8:30 PM and include a presentation at 7:00 PM. Public meetings are planned for the following dates and locations:

- **Phoenix**: Tuesday, March 20, Sheraton Crescent Hotel, 2620 West Dunlap Avenue
- **Flagstaff**: Wednesday, March 21, High Country Conference Center, 201 West Butler Avenue
- **Kingman**: Thursday, March 22, Hampton Inn, 1791 Sycamore Avenue
- **Yuma**: Tuesday, April 10, Yuma Civic and Convention Center, 1440 Desert Hills Drive
- **Tucson**: Wednesday, April 11, Holiday Inn, 4550 South Palo Verde Road

Any changes to these meetings will be announced at least 15 days in advance through local media, newspapers, and the project Web site.

Copies of the Draft EIS have been sent to affected federal, state, and local government agencies and applicable tribal governments. Requests for additional information regarding the Draft EIS should be directed to Kathy Pedrick, RDEP Project Manager, at 602-417-9235. Requests for copies of the document should be directed to the project email address: az_arra_rdep@blm.gov or to Lane Cowger at 602-417-9612. You may also visit the project website at: www.blm.gov/az/st/en/prog/energy/arra_solar.html.

Thank you for your interest in the RDEP. We appreciate your contributions to the NEPA and planning process.

Sincerely,



Raymond Suazo
State Director

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ARIZONA RESTORATION DESIGN ENERGY PROJECT

Lead Agency: U.S. Department of the Interior (DOI), Bureau of Land Management (BLM)

Cooperating Agencies: U.S. Bureau of Reclamation, Western Area Power Administration, Arizona Game and Fish Department, Arizona State Land Department, Arizona Department of Environmental Quality, Arizona Corporation Commission, Central Arizona Water Conservation District, and Arizona Department of Water Resources

Location: Arizona

Contacts: *Requests for additional information regarding the Draft Environmental Impact Statement:*
Kathy Pedrick, Restoration Design Energy Project Manager, 602-417-9235
Requests for copies of the document:
az_arra_rdep@blm.gov or Lane Cowger, 602-417-9612
Project Web site: www.blm.gov/az/st/en/prog/energy/arra_solar.htm

Abstract: The Restoration Design Energy Project (RDEP) is a project of BLM Arizona that supports the Secretary of the Interior's goals to build America's new energy future and to protect and restore treasured landscapes. BLM Arizona proposes to identify Renewable Energy Development Areas (REDA) and to establish management actions, design features, and land tenure and reuse policies applicable to solar and wind energy development on BLM-administered lands in Arizona. The REDAs would identify where solar and wind energy development is likely to be compatible with resource objectives, and the management actions and design features would bring consistency and efficiency to the BLM's authorization process. In addition, the BLM is proposing to identify a Solar Energy Zone for utility-scale solar development. BLM resource management plans in Arizona would be amended to adopt these findings and measures.

The environmental impact statement (EIS) evaluates the No Action Alternative and six action alternatives. Identifying lands as REDAs was an iterative process that provided a range of alternatives. Public scoping and collaboration with cooperating agencies and stakeholders revealed that renewable energy development would be best suited on lands that are disturbed and/or have low resource sensitivity. Lands with low resource sensitivity are areas that are unlikely to contain resources protected by statute or policy, that currently do not have special designations or uses, that are unlikely to contain other recognized values, or for which impacts from development cannot be mitigated. After defining the maximum REDA as the first action alternative, the BLM developed additional alternatives based on planning issues, including transmission, load centers, water, and land tenure. The final action alternative, which is identified as the BLM's preferred alternative, is a combination of these themes.

Comments on this Draft EIS will be accepted for ninety (90) calendar days following the date the U.S. Environmental Protection Agency publishes its Notice of Availability in the *Federal Register*.

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ACRONYMS AND ABBREVIATIONS

	Full Phrase
ACC	Arizona Corporation Commission
ACEC	area of critical environmental concern
AZ DOC	Arizona Department of Commerce
ADWR	Arizona Department of Water Resources
AMA	active management area
ANPL	Arizona Native Plant List
ARRTIS	Arizona Renewable Resource and Transmission Identification Subcommittee
ASLD	Arizona State Land Department
AUM	animal unit month
AZDA	Arizona Department of Agriculture
AZ DOR	Arizona Department of Revenue
AZGFD	Arizona Game and Fish Department
AZGS	Arizona Geological Survey
AZSITE	Arizona Archaeological Site and Survey Database
BLM	United States Department of the Interior, Bureau of Land Management
BLM-administered public lands	surface acres administered by the United States Department of the Interior, Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	best management practice
BOR	Bureau of Reclamation
CAA	Clean Air Act
CEDC	Commerce and Economic Development Commission
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO_2	carbon dioxide
CO_{2e}	carbon dioxide equivalents
CSP	concentrating solar power
CWA	Clean Water Act
dBA	A-weighted decibel
DNI	Direct Normal Irradiance
DNL	day-night average noise level
DOD	United States Department of Defense
DOE	United States Department of Energy
DOI	United States Department of the Interior
EA	environmental assessment
EIS	environmental impact statement
EMF	electromagnetic frequency
EO	Executive Order
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FLPMA	Federal Land Policy and Management Act of 1976
Forest Service	United States Department of Agriculture, Forest Service

	Full Phrase
FY	fiscal year
GHG	greenhouse gases
GIS	geographic information system
GLO	General Land Office
GW	gigawatt
GWh	gigawatt-hour
HA	herd area
HMA	herd management area
INA	Irrigation Non-expansion Areas
KOP	key observation point
kV	kilovolt
LAUS	Local Area Unemployment Statistics
L_{DN}	day-night average sound level
L_{EQ}	equivalent sound pressure level
L_{10}	noise level exceeded 10 percent of the time
L_{50}	noise level exceeded 50 percent of the time
L_{90}	noise level exceeded 90 percent of the time
MBTA	Migratory Bird Treaty Act
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
MOU	Memorandum of Understanding
MTR	Military Training Route
MW	megawatt
NAAQS	national ambient air quality standards
NEPA	National Environmental Policy Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NLCS	National Landscape Conservation System
NPDES	National Pollutant Discharge Elimination System
NPS	United States Department of the Interior, National Park Service
NRA	National Recreation Area
NRCS	United States Department of Agriculture, Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWRS	National Wildlife Refuge System
OES	Occupational Employment Statistics
OHV	off-highway vehicle
O&M	Operations and Maintenance
PEIS	programmatic environmental impact statement
PFYC	Potential Fossil Yield Classification

	Full Phrase
planning area	State of Arizona, including all lands, regardless of land ownership
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
POD	plan of development
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
PV	photovoltaic
RDEP	Restoration Design Energy Project
REDA	renewable energy development area
RFDS	Reasonably Foreseeable Development Scenario
RMP	Resource Management Plan
ROD	Record of Decision
ROW	right-of-way
RMZ	recreation management zone
RPS	Renewable Portfolio Standard
SDWA	Safe Drinking Water Act
SEZ	Solar Energy Zone (utility-scale solar)
SGCN	species of greatest conservation need
SHPO	State Historic Preservation Office
SRMA	special recreation management area
SOC	Standard Occupation Classification
SUA	special use area
SWA	State Wildlife Area
SWreGAP	Southwest Regional GAP Analysis Project
TCP	traditional cultural property
$\mu g/m^3$	micrograms per cubic meter
U.S.	United States
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VRI	visual resource inventory
VRM	visual resource management
WHA	Wildlife Habitat Area
WPZ	Water Protection Zone
WREZ	Western Renewable Energy Zones
WSA	wilderness study area
YPG	U.S. Army Yuma Proving Ground

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EXECUTIVE SUMMARY

ES.1 OVERVIEW

Renewable Arizona Fast Facts

Suitable solar resource potential: 57% of the state

Suitable wind resource potential: 2% of the state

By 2025, at least 15 percent of Arizona's electrical demand will be met with renewable energy

Total BLM-administered lands in Arizona: 12.2 million acres

The Restoration Design Energy Project (RDEP) is a project of BLM Arizona that supports the Secretary of the Interior's goals to build America's new energy future and to protect and restore treasured landscapes. Arizona has a wealth of renewable energy resources, especially for those technologies that rely on solar radiation and wind (Black and Veatch 2007). The United States (U.S.) Department of the Interior (DOI), Bureau of Land Management (BLM) manages over 12 million surface acres of public lands in Arizona. Wind and solar projects on public lands are administered by the BLM lands and realty program through right-of-way (ROW) grants in accordance with land use plans.

The BLM proposes to identify Renewable Energy Development Areas (REDAs) and a Solar Energy Zone (SEZ) for Arizona that include disturbed sites such as brownfields, landfills, retired agricultural lands, or abandoned mines, and lands with low resource sensitivity and few environmental conflicts. The BLM also proposes to establish management actions, design features, and land tenure and reuse policies applicable to solar and wind energy development on BLM-administered lands in Arizona. The REDAs would identify where solar and wind energy development is likely to be compatible with resource objectives, and the management actions and design features would bring consistency and efficiency to the BLM's authorization process. In addition, the BLM is proposing to identify a SEZ for utility-scale solar development. BLM resource management plans (RMPs) in Arizona would be amended to adopt these findings and measures.

BLM Arizona has prepared this environmental impact statement (EIS) to identify which lands across Arizona are most suitable for the development of renewable energy and to consider establishing a baseline set of environmental protection measures that would apply to such projects on

public lands. This EIS evaluates the potential environmental, social, and economic effects resulting from this proposed action in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality's regulations for implementing NEPA (40 Code of Federal Regulations Parts 1500-1508), and applicable DOI and BLM authorities.

ES.2 PURPOSE AND NEED FOR THE RDEP

A growing demand for energy in the western U.S. combined with applicable laws, orders, and policies that encourage the DOI and the BLM to facilitate renewable energy siting and production has created a need for BLM Arizona to consider updating and amending their land use plans. Siting renewable energy projects is complex and multifaceted, requiring the consideration of many variables, including topography, distance to transmission and load, land ownership patterns and availability, tribal concerns, and environmental and cultural resource constraints. Current land use plans generally do not address these factors or provide guidance on where development should occur. Therefore, under current plans, processing of applications can take a long time to adequately evaluate the site location, to conduct environmental and cultural reviews, to develop appropriate mitigation measures, to effectively collaborate with stakeholders, and, in some cases, to prepare a land use plan amendment.

Renewable energy comes from natural resources whose supplies are regenerative and virtually inexhaustible, including sunshine, wind, water, vegetation, and the heat of the earth. The Restoration Design Energy Project focuses on solar and wind resources.

The purpose of the RDEP is to conduct smart, statewide planning to foster environmentally responsible production of renewable energy and to allow the permitting of future renewable energy development projects to proceed in a more efficient and standardized manner. The RDEP would amend land use plans to identify geographic areas best suited for renewable energy, establish land reuse goals, and identify design features to protect resource values and uses.

While RDEP would further the BLM's ability to meet the mandates of Executive Order (EO) 13212, Actions to Expedite Energy-Related Projects (Federal Register, Volume 66, page 28357, May 22, 2001) and the Energy Policy Action of 2005, it also has been designed to meet the requirements of Secretarial Order 3285A1 related to identifying areas best suited for renewable energy (Secretary of the Interior 2010).

ES.3 THE RDEP'S RELATIONSHIP TO NATIONAL AND STATEWIDE BLM POLICIES AND PROGRAMS

Numerous federal and state BLM initiatives are currently underway to promote renewable energy development.

ES.3.1 Solar Energy Development Programmatic EIS

The Solar Energy Development Programmatic EIS (PEIS), currently being prepared by the U.S. Department of Energy (DOE) and the BLM, will assess environmental impacts associated with the development and implementation

Solar PEIS Proposed SEZs



of agency-specific programs that would facilitate environmentally responsible, utility-scale solar energy development in six western states: Arizona, California, Colorado, New Mexico, Nevada, and Utah. There are two proposed SEZs in Arizona being carried forward in the Solar PEIS– the Brenda SEZ and the Gillespie SEZ. The two proposed SEZs in Arizona encompass 6,465 acres. As the Solar PEIS is finalized, it may modify the boundaries of the proposed SEZs or remove them, but no new SEZs will be proposed through the Solar PEIS. The Record of Decision (ROD) for the Solar PEIS is anticipated for September 2012.

The Solar PEIS effort and the RDEP are being closely coordinated as both are related to making land use planning decisions for the most suitable areas to develop solar energy facilities. The RDEP is a "step down" from the national level to focus on specific issues and areas in Arizona. Upon issuance of the ROD for the Solar PEIS, land use plans in Arizona will be amended to incorporate the land use plan decisions described above. The RDEP effort seeks to further refine and build upon the decisions being analyzed in the Solar PEIS for utility-scale solar, including the following:

- The RDEP will identify those areas most suitable for renewable energy development within the variance areas identified by the Solar PEIS (i.e., a REDA). Identification of a REDA could fulfill the variance process requirements proposed in variance areas through the Supplement to the Draft Solar PEIS (BLM and DOE 2011). This would allow utility-scale solar energy developers a more streamlined process in these highly suitable areas.
- The RDEP would refine and build upon the design features being proposed in the Solar PEIS for conditions relevant to wind and solar development in Arizona.
- In accordance with the identification protocols for new SEZs (as identified in the Supplement to the Draft Solar PEIS), the RDEP is proposing and analyzing an additional SEZ for Arizona.

A summary of the scope of each of the two projects is provided in **Table ES-1**, Comparison of the Scope of the Solar PEIS and the RDEP.

Solar radiation may be harnessed and transformed to usable energy, such as heat and electricity. Two basic solar energy technologies that produce electrical power for commercial applications are:

- *Concentrating solar power (CSP) systems, which use mirrors to concentrate sunlight onto receivers that convert it to heat used to drive a generator via a steam turbine or heat engine to produce electricity*
- *Photovoltaic (PV) systems, which use solar cells made of semiconductor materials to capture the energy in sunlight and convert it directly into electricity*

Table ES-1
Comparison of the Scope of the Solar PEIS and the RDEP

Solar PEIS	RDEP[1]
Applies to: Utility-scale solar energy developments (≥20 MW) ONLY	Applies to: Solar-based energy technologies and wind energy technologies
• Allocations: - Exclusion Areas - Variance Areas (Variance Process required) - SEZs – two in Arizona: ▪ Brenda ▪ Gillespie • Solar Energy Development Program Policies & Procedures • Solar Energy Development Program Design Features	• Identify REDAs within Variance Areas • Identify the Agua Caliente SEZ • Wind Energy Program policies and procedures from the Wind Energy Program ROD • Goals, Management Actions, and Design Features for solar and wind renewable energy development regardless of scale, land reuse, and remediation of disturbed sites

ES.3.2 Wind Programmatic EIS

Wind power utilizes turbines to convert wind to electricity. The blades of a wind turbine turn in the moving air and power an electric generator that supplies an electric current.

In 2005, the BLM prepared a comprehensive PEIS to guide wind energy development in 11 western states: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming (BLM 2005b). The U.S. DOE cooperated in the preparation of the Wind PEIS in support of the BLM's proposed action. The decision established policies and BMPs for the administration of wind energy development activities and established minimum requirements for mitigation measures. Fifty-two BLM land use plans were amended to adopt the new program; no plans in Arizona were amended as a result of the Wind PEIS. The RDEP analyzes the Wind Program policies, BMPs, and land use plan decisions relevant to Arizona and will decide whether to adopt the policies, BMPs, and land use plan decisions for Arizona. The RDEP will identify areas best suited for wind energy development for inclusion in the REDAs and will consider any additional design features, management actions, and/or BMPs to include for wind energy projects in Arizona.

ES.3.3 BLM Arizona Strategic Goals

Energy Strategy

Recent interest in renewable energy development in Arizona, and in the West in general, has led to a large interest in the use of public lands for siting of renewable energy projects. BLM Arizona has developed a BLM Arizona Statewide Energy Strategy to help manage the need for renewable energy locations on public lands, including processing of existing

[1] The ROD resulting from the Solar PEIS will amend Arizona land use plans for utility-scale solar energy development. All of the decisions included in the Solar PEIS ROD would apply and would be implemented.

applications, participation in the Solar PEIS, and the development of the RDEP. Some of the goals of the Energy Strategy include participating with state and private entities to develop renewable energy strategies for all of Arizona, responsively processing renewable energy applications, and developing a plan for renewable energy developments in an environmentally responsible manner.

Other BLM Arizona Strategies

In addition to the Energy Strategy, BLM Arizona has established other strategies to provide long-term direction and priority setting for BLM Arizona. The strategies reflect current DOI and BLM strategic direction, knowledge of BLM Arizona workload, expected funding, and citizen expectations. The main goals include the following:

- Promote the sustainability of public lands by directing renewable energy onto lands with low resource conflicts;
- Be effective stewards of heritage resources by engaging government-to-government consultation with tribal governments and thoroughly considering cultural resources in environmental analysis; and
- Support community use of BLM-administered lands, especially through promotion of renewable energy.

ES.4 DECISIONS TO BE MADE BY THE RDEP

As discussed above, the RDEP process includes: (1) analyzing lands and realty program planning actions related to identifying REDAs and a SEZ, and (2) analyzing goals, management actions, and design features for renewable energy development ROWs.

Renewable energy developments proposed outside of a REDA or SEZ would be considered on a case-by-case basis using applicable national policy direction and guidance from existing land use plan decisions.

ES.4.1 Decisions on the REDA

The Arizona Strip Field Office RMP (BLM 2008d), Phoenix Resource Area RMP (BLM 1988; Lower Sonoran portion of planning area), Bradshaw-Harquahala RMP (BLM 2011l), Safford RMP (BLM 1991), Kingman Resource Area RMP (BLM 1995a), Yuma RMP (BLM 2010g), and Lake Havasu RMP (BLM 2007a) will be amended to:

- Identify REDAs for renewable energy development;
- Establish goals, objectives, and management actions for renewable energy development;

- Identify REDA land disposal criteria for future land disposal allocation decisions and disposal actions, including land exchanges and sales; and
- Identify terms and conditions, including design features and mitigation measures to minimize environmental impacts and that can be used to guide development at the local level (see **Appendix B**, Design Features and Best Management Practices).

Disturbed Lands and Nominated Parcels

A key component of the RDEP is emphasizing the reuse of previously disturbed or developed lands that, after remediation or site preparation, may be suitable for renewable energy development, thereby reducing impacts on sensitive resources. With this in mind, BLM Arizona and members of the public identified 64 previously utilized sites on BLM-administered, state, municipal, and private lands; site types include gravel pits, mine sites, retired agricultural lands, landfills, isolated parcels that have been disturbed, and abandoned unauthorized airstrips (see **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites. The site boundaries generally follow ownership patterns or other geographic references. All lands in the boundaries may or may not have been disturbed depending on the use and how the site was nominated.

All nominated sites are identified as REDAs for analysis along with other lands with low resource sensitivity. To further plan for and support reuse of disturbed lands, the RMPs would also be amended to:

- Establish goals, objectives, and management actions for land reuse and sustainability practices; and
- Establish goals, objectives, and management actions for remediation of previously disturbed lands.

Nominated sites not on BLM-administered public lands will not be subject to these decisions, but these sites are considered part of the planning and analysis area to help BLM decision-making on adjacent suitable public lands. **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites provides analysis of all nominated sites. This analysis will help inform state, tribal, and local governments and agencies and serve as a resource for the general public, policy makers, and energy planners that are considering renewable energy projects on these sites.

ES.4.2 Decisions on the SEZ

In addition to identifying REDAs, the RDEP is serving as a step-down process to the Solar PEIS for utility-scale solar development. As such, the BLM is also proposing to identify a SEZ to facilitate the development of utility-scale solar projects. As discussed in Chapter 2, the proposed SEZ is called Agua Caliente and is located in the BLM's Yuma Field Office planning

area of southwest Arizona. Based on the EIS analysis, the BLM may decide to carry forward the proposed Agua Caliente SEZ and would then amend the Yuma RMP to:

- Identify the Agua Caliente SEZ;
- Establish renewable energy goals, objectives, management actions, and design features for application in the SEZ;
- Identify SEZ-specific design features;
- Change the visual resource management (VRM) designations in the SEZ from VRM Class III to Class IV; and
- Remove the Special Recreation Management Area designation from within the Agua Caliente SEZ.

The BLM Arizona State Director has filed notice to segregate the proposed Agua Caliente SEZ study area (20,776 acres) from appropriation under the public land and mining laws for a period of two years. The purpose of the segregation is to protect this area from encumbrances, particularly mining claims, while the study area is evaluated in this EIS.

ES.4.3 Requirements for Further Environmental Analysis

This EIS will not eliminate the need for site-specific environmental review for future individual renewable energy development proposals; the BLM will make individual decisions on a case-by-case basis whether or not to authorize individual renewable energy development projects in conformance with the amended land use plan on the basis of this EIS. The BLM retains the discretion to deny solar and wind ROW applications based on site-specific issues and concerns, even in those areas available or open for application in the existing land use plan.

In cases where a broad policy, plan, program, or project will later be translated into site-specific projects, subsequent analyses are referred to as "tiered" analyses. Tiering refers to the coverage of general matters in a broader EIS, such as state-wide program or policy statements, with subsequent narrower EISs or environmental assessments (EAs), such as site-specific proposal documents, incorporating by reference the general discussions and concentrating solely on the issues specific to the subsequent EIS or EA (40 Code of Federal Regulation [CFR] 1508.28). Site-specific environmental reviews for renewable energy development projects that begin after the ROD for this EIS is finalized will be tiered to this EIS.

ES.5 SCOPE OF ANALYSIS

The RDEP has a programmatic focus. The EIS provides the BLM, the State of Arizona, county and local governments, tribal governments, utility companies, the renewable energy industry, and the public with a better

understanding of the environmental and economic issues associated with developing renewable energy in Arizona.

ES.5.1 Scope of the REDA Analysis

The scope of the EIS encompasses a wide range of renewable energy resources and technologies, including solar-based technologies and wind energy technology.[2] For a detailed discussion of what types of technologies are assumed, see **Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona.

Along with the BLM-administered lands with low resource sensitivity, the 64 nominated sites described earlier are included as part of the REDAs. As the BLM does not have jurisdiction to apply management decisions to non-BLM-administered lands, the RDEP land use and management decisions only apply to BLM-administered lands. While any decisions made related to renewable energy development within the REDAs would apply only to the BLM-administered nominated sites, non-BLM-administered sites were also included in the RDEP planning and analysis areas. This analysis will help inform state, tribal, and local governments and agencies and serve as a resource for the general public, policy makers, and energy planners that are considering renewable energy projects on these sites. Additional suitable disturbed lands may continue to be identified over time and may be considered in this or subsequent analyses.

ES.5.2 Scope of the SEZ Analysis

In addition to the programmatic analysis for the REDAs, the BLM conducted a statewide review and identified the proposed Agua Caliente SEZ as a candidate for analysis. The screening criteria focused on large blocks of BLM-administered lands that have limited sensitive resources, are located near existing solar energy developments, were previously disturbed, and are near existing road and transmission infrastructure. This EIS provides in-depth environmental analysis on the proposed Agua Caliente SEZ as a location suitable for utility-scale solar energy development.[3] The primary purpose of this more rigorous analysis is to provide documentation from which the BLM can tier future project authorizations, thereby limiting the required scope and effort of project-specific NEPA analyses. The BLM would complete a site-specific environmental review of all solar energy ROW applications in accordance with NEPA prior to issuing a ROW

[2] Geothermal resources are classified as a fluid mineral and are administered under separate laws and regulations from the lands and realty program and are not part of the RDEP project and environmental analysis. In December 2008, the BLM signed the ROD and RMP Amendments for geothermal leasing in the Western U.S. (BLM 2008b). This decision amended all of the land use plans in Arizona to provide the appropriate allocations, stipulations, and procedures to facilitate the leasing of geothermal resources in the state.

[3] For the purpose of the RDEP, "utility-scale" solar energy development is defined as projects capable of generating 20 MW or greater. Viable utility-scale solar technologies to be deployed over the next 20 years include parabolic trough, power tower, dish engine systems, and photovoltaics.

authorization. All future projects proposed in the Agua Caliente SEZ could tier to the analysis in this EIS. The extent of this tiering, however, would vary by project, as would the necessary level of NEPA documentation.

ES.6 ALTERNATIVES

This EIS evaluates six action alternatives and the No Action Alternative. Identifying lands as REDAs was an iterative process that provided a range of alternatives. Public scoping and collaboration with cooperating agencies and stakeholders revealed that renewable energy development would be best suited on lands that are disturbed and/or have low resource sensitivity. Lands with low resource sensitivity are areas that are unlikely to contain resources protected by statute or policy, that currently do not have special designations or uses, that are unlikely to contain other recognized values, or for which impacts from development cannot be mitigated (for example, groundwater is a sensitive resource in many parts of Arizona; however, the BLM has the authority to require non-consumptive technologies to mitigate the impact). The BLM collected relevant information from BLM datasets, cooperating agencies, stakeholders, universities, and other public sources. The complete listing of these resource datasets is in **Table ES-2**, Areas with Known Sensitive Resources (Eliminated from REDA Consideration). The data were loaded into a GIS and analyzed to geographically identify low-sensitivity lands that could be suitable for renewable energy development. These lands represent Alternative 1, Maximum REDA.

After defining the Maximum REDA, the BLM looked to the main planning issues to form the themes of the other action alternatives: transmission issues, water issues, disposal/land tenure issues, previously disturbed lands, and load centers. Four of the issue categories – transmission, water, land tenure, and load centers – formed the core of four action alternatives, with the idea for reusing previously disturbed lands being included as an option for all alternatives. Based on these themes, the BLM developed Alternatives 2 through 5 by overlaying issue-specific GIS layers (e.g., existing and proposed transmission corridors) on the Maximum REDA alternative.

Alternative 6, the Collaborative-Based Alternative, combines the analysis from the other alternatives to address the planning issues. **Figure ES-1**, REDA - Areas Eliminated from Consideration: Comparison of Baseline Data Used in Alternative Development, shows areas with high resource sensitivity that were eliminated from inclusion in the Maximum REDA, as well as how the other action alternatives were developed. This figure can be found at the end of the Executive Summary.

While decisions made from this EIS will only apply to BLM-administered public lands, the analysis was conducted statewide regardless of land status to facilitate statewide planning and identify areas for possible partnering

Table ES-2
Areas with Known Sensitive Resources (Eliminated from REDA Consideration)

Areas with Known Sensitive Resources	Source
BLM Areas of Critical Environmental Concern (ACECs)	BLM 2011b
BLM Backcountry Byways	BLM 2011b
BLM Designated Wilderness and Wilderness Study Areas	BLM 2011b
BLM Lands with wilderness characteristics managed to protect those characteristics	BLM 2011b
BLM Lands with wilderness characteristics not managed to protect those characteristics	BLM 2011b
BLM Visual Resource Management Classes I, II, and III	BLM 2011b
BLM Special Recreation Management Areas	BLM 2011b
BLM ROW exclusion or avoidance areas	BLM 2011b
BLM Herd Management Areas	BLM 2011b
Gila River Terraces (proposed cultural resources ACEC)	BLM 2011b
Designated BLM Utility Corridors	BLM 2011b
National Monuments	BLM 2011b
National Conservation Areas	BLM 2011b
Wild and Scenic Rivers (either eligible or suitable for inclusion in the National Wild and Scenic Rivers System or rivers included in the National Wild and Scenic Rivers System)	BLM 2011b
National Park System units, including Petrified Forest National Park Expansion Area	BLM 2011b, SWReGAP 2011
National Park System National Historic Trails (0.25-mile buffer)	BLM 2011b
Indian Lands	BLM 2011b
Military Lands	BLM 2011b
State Parks	Arizona State Parks 2010
State Wildlife Areas	BLM 2011b
U.S. Fish and Wildlife Service (USFWS) lands	BLM 2011b
The Nature Conservancy conservation easements, Audubon Society land, and private conservation easements	SWReGAP 2011
U.S. Forest Service (U.S. Forest Service) Designated Wilderness	Forest Service 2010a
U.S. Forest Service Established Research Natural Areas	Forest Service 2010b
U.S. Forest Service Inventoried Roadless Areas	Forest Service 2010c
U.S. Forest Service Heber Wild Horse and Burro area	Forest Service undated
U.S. Forest Service Special Interest Management Areas	Forest Service 2010b
Airports (0.25-mile buffer)	National Atlas 2010

Table ES-2 *(continued)*
Areas with Known Sensitive Resources (Eliminated from REDA Consideration)

Areas with Known Sensitive Resources	Source
Incorporated cities (except when BLM land is included within boundary of an incorporated city)	ALRIS 2011a
Arizona Game and Fish Department Areas of Conservation Potential, Tiers 4, 5, and 6	AZGFD 2011a
Arizona Game and Fish Department big game habitat, including bighorn sheep, black bear, elk, javelina, mountain lion, mule deer, turkey, white-tailed deer	AZGFD 1988
Special status species, including threatened, endangered, and BLM sensitive species locations	AZGFD 1988
Arizona Game and Fish Department wildlife corridors	AZGFD (undated)
USFWS critical habitat for threatened and endangered species	USFWS 2010
BLM sensitive species habitat	BLM 2011b
Desert tortoise (*Gopherus agassizii*) Sonoran population habitat categories I, II, and III	BLM 2011b
National Wetland Inventory wetlands	NWI 2010
Waterbodies (lakes, rivers, and dry lakes)	BLM 2011b
Federal Emergency Management Agency 100-year floodplains	FEMA 2010
Areas of high potential for known mineral deposits, metallic mineral districts, Holbrook Basin potash potential	AZGS 2008, Arizona Bureau of Geology and Mineral Technology 1983, Arizona Bureau of Mines 1993
Sensitive fossil resources	BLM 2011b
Severe soils: Clay Springs (runoff medium to rapid and erosion hazard moderate to severe) and Rositas (wind erosion severe if natural surface and cover disturbed)	BLM 2011b, Description of Soil Series 2010
Greater than 5-percent slopes (or greater than 15-percent slopes for areas with wind potential)	USGS 2010, BLM 2011b

between the BLM and other federal or state agencies and private land owners. Unless specifically nominated, the analysis does not include tribal or Department of Defense lands.

In addition to identifying REDAs, the RDEP is serving as a step-down process to the Solar PEIS. As such, the BLM is also proposing to identify the Agua Caliente SEZ to facilitate the development of utility-scale solar projects. The proposed SEZ was developed based on a screening process that included the following criteria: available large contiguous parcels of BLM land (greater than 2,500 acres); proximity to transmission; limited known

environmental or cultural constraints; proximity to roads and infrastructure; and adjacent to existing solar developments. All of the lands within and adjacent to the Maximum REDA were reviewed. The Agua Caliente area proved to best meet the criteria. After identification of the proposed SEZ, the BLM solicited the local BLM office (the Yuma Field Office), regional Arizona Game and Fish office, and stakeholder groups for resource information specific to that location. These groups provided information indicating that portions of the SEZ had excellent recreational hunting access and use, cultural resources, and proposed wildlife reintroduction locations. As a result of this input, two smaller SEZ footprints were proposed for consideration. Five of the action alternatives contain either the small, medium, or large proposed SEZ footprint as an element of the alternative; one action alternative does not propose a SEZ.

The final Agua Caliente SEZ boundary will be defined in the ROD for this EIS. Any development of the proposed Agua Caliente SEZ would be required to follow the requirements of the Solar Energy Program from the Solar PEIS and management actions, design features, and BMPs contained in this EIS. Additionally, the BLM would petition the Secretary of the Interior to withdraw the proposed Agua Caliente SEZ from settlement, sale, location, or entry under the general land laws, including the mining laws, to protect and preserve the area for future solar energy development.

ES.6.1 No Action Alternative

Under the No Action alternative, renewable energy projects would be developed through ROW authorizations and land disposal actions in accordance with the BLM's existing lands and realty policies, existing solar or wind development policies, and existing RMP decisions. Additionally, the BLM would not identify the Agua Caliente SEZ.[4]

ES.6.2 Alternative 1: Maximum REDA

The purpose of this alternative is to maximize opportunities for developing renewable energy while avoiding sensitive resources. It seeks to provide maximum flexibility for locating small- to large-scale projects without consideration of other physical constraints, such as distance to transmission or load. By eliminating known sensitive resources (see **Table ES-2**, Areas with Known Sensitive Resources (Eliminated from REDA Consideration)), this alternative illustrates the areas that have a higher likelihood of fewer resource obstacles to development. Alternative 1 analyzes the large SEZ footprint (20,600 acres).

Table ES-3, Summary of Acres for Alternatives, gives the number of REDA acres and SEZ acres for each alternative as distributed across all lands and

[4] Should the Solar PEIS result in a ROD, those decisions would likely result in changes to how utility-scale solar development is authorized on BLM-administered lands in Arizona.

public lands; **Figure ES-2,** Comparison of Conceptual Alternatives of REDA on BLM-Administered Lands and **Figure ES-3**, Comparison of Conceptual Alternatives of REDA on Non-BLM-Administered Lands, included at the end of this Executive Summary, provide an overview of the alternatives analyzed in the EIS.

Table ES-3
Summary of Acres for Alternatives

	BLM-Administered Land	Non-BLM-Administered Land	Proposed Agua Caliente SEZ
Alternative 1: Maximum REDA	321,500	2,367,900	20,600
Alternative 2: Transmission Line and Utility Corridor REDA	218,600	1,680,600	6,770
Alternative 3: Load Offset REDA	129,800	1,121,500	2,760
Alternative 4: Water Conservation and Protection REDA	321,500	2,367,900	20,600
Alternative 5: Land Tenure REDA	43,700	N/A	0
Alternative 6: Collaborative–Based REDA	237,100	1,795,300	6,770

ES.6.3 Alternative 2: Transmission Line and Utility Corridor REDA

This alternative responds to scoping comments that wanted the BLM to find renewable energy facility locations close enough to transmission to make it efficient and cost effective to bring the energy on-line and deliver it to the people who need it. This alternative seeks to reduce environmental impacts by focusing renewable energy development on lands within reasonable proximity to designated utility corridors and existing or certified transmission lines. For this alternative, the BLM started with the Maximum REDA lands (Alternative 1), and then narrowed them further to lands within five miles of an existing or planned transmission line, including: (1) BLM-designated utility corridors, including the West Wide Energy Corridors; (2) existing transmission lines 230 kilovolt (kV) or greater; and (3) reasonably foreseeable proposed transmission lines 230 kV or greater. Under Alternative 2, the footprint of the Agua Caliente SEZ would be reduced to 6,770 acres.

ES.6.4 Alternative 3: Load Offset REDA

The purpose of Alternative 3 is to reduce disturbance and environmental impacts by keeping energy generation near the point of demand, such as cities, towns, or industrial centers, and to help Arizona meet Arizona's Renewable Portfolio Standard commitments. Keeping energy generation near the point of demand offsets urban, rural, or industrial demand by

serving both large and smaller loads; reduces load required from the larger power grid, thereby allowing routing to other locations using existing transmission; provides opportunities for utility-scale and distributed energy; and promotes the development of renewable energy industrial parks near Palo Verde Nuclear Generating Station and the town of Gila Bend.

The BLM considered only those lands identified under Alternative 1 within a 10-mile area around all incorporated cities in Arizona (ALRIS 2011a), a 5-mile area around the Central Arizona Project ROW and known irrigation sources, a 20-mile area around the Palo Verde Nuclear Generating Station, and a 20-mile area around the town of Gila Bend. Under Alternative 3, the footprint of the proposed Agua Caliente SEZ would be reduced to 2,760 acres.

ES.6.5 Alternative 4: Water Conservation and Protection REDA

The Water Conservation and Protection REDA alternative is intended to respond to public concerns over water availability in Arizona, potential effects on other water users, and how renewable energy facilities will impact water resources. It focuses on avoiding impacts on sensitive surface watersheds, protecting and maintaining groundwater quality and quantity, and reducing consumptive use of water.

Alternative 4 was developed from the Maximum REDA (Alternative 1). While the Maximum REDA (Alternative 1) addresses some water issues, this alternative goes further by proposing water protection zones that provide additional design features to protect water resources in areas with known water supply issues (defined in **Table 2-6**, Water Protection Zones in Chapter 2). **Table ES-4**, Alternative 4: Acres within Water Protection Zones for REDAs and the Proposed Agua Caliente SEZ, shows the breakdown of the overall REDA acreage by water protection zone. As part of the required water resources mitigation and monitoring plan, applicants could include water conservation and replenishment techniques such as importing water, treating and using brackish water, capturing and using storm water runoff, water retirement, use of recycled or waste water, and vegetation treatments (such as tamarisk removal). The proposed Agua Caliente SEZ analysis area is the same as described in Alternative 1 (20,600 acres).

ES.6.6 Alternative 5: Land Tenure REDA

The Land Tenure REDA alternative meets the purpose and need for the RDEP in planning for environmentally sound renewable energy development on public lands in Arizona by focusing on lands which prior planning processes have concluded are suitable for disposal. These public lands are both within the Maximum REDA (the area identified in Alternative 1) and have been identified as suitable for disposal in existing land use plans. These lands were identified as suitable for general disposal for a number of

Table ES-4
Alternative 4: Acres within Water Protection Zones for REDAs and the Proposed Agua Caliente SEZ

	BLM-Administered Land (acres)	Non-BLM-Administered Land (acres)
Water Protection Zone 3	130,700	760,200
Water Protection Zone 2	47,900	386,500
Water Protection Zone 1	142,900	1,221,200
Total REDA	*321,500*	*2,367,900*
Proposed Agua Caliente SEZ (Water Protection Zone 2)	20,600	0
Total REDA and SEZ	*342,100*	*2,367,900*

reasons, including low resource values, previous disturbance, and isolation from larger blocks of public land, which has made managing them as public lands difficult. This would be an option for any RDEP alternative in addition to being. There is no SEZ proposed under this alternative.

ES.6.7 Alternative 6: Collaborative-Based REDA (Preferred Alternative)

While the previous five alternatives each address some of the aspects of renewable energy issues and concerns brought forth during scoping, Alternative 6: Collaborative-Based REDA incorporates all of the concepts, issues, and protections from the other five alternatives into a "blended" alternative. Once the other five alternatives were conceptually developed, the BLM made them available for review by stakeholders, the public, and cooperating agencies. Based on this outreach, the BLM refined the alternatives and developed the Collaborative-Based REDA that includes:

- Areas that are more likely to have fewer resource conflicts that may affect development;
- Areas close enough to transmission to make it efficient and cost effective to bring the energy on-line;
- Energy generation areas near the point of demand, such as cities, towns, or industrial centers; and
- Additional resource protection measures:
 - Water resource design features for each water protection zone; and

- Prioritize the disposal of these lands to renewable energy purposes, and adding criteria to favor disposal in a manner that creates additional social and environmental benefits (see Alternative 5).

This alternative combines the transmission areas and load centers data from Alternatives 2 (Transmission REDA) and 3 (Load Offset REDA). Locating areas close to transmission and load centers provides the context for where electricity demand is and where renewable energy projects may be developed in the future. Resource protection elements were added to these lands, specifically by including the water resource protections (design features) from Alternative 4 to address the water availability concerns, and prioritizing available disposal lands for renewable energy purposes that would favor disposal in a manner that creates additional social and environmental benefits (Alternative 5). **Table ES-5** shows the breakdown of the overall REDA acreage by water protection zone and by lands available for disposal.

Table ES-5
Alternative 6: Collaborative-Based REDA and Proposed Agua Caliente SEZ

	BLM-Administered Land (acres)	Non-BLM-Administered Land (acres)
Alternative 6: Collaborative Alternative	237,100	1,795,300
Proposed Agua Caliente SEZ (Water Protection Zone 2)	6,770	0
Acreage with Resource Protections		
Water Design Features		
Water Protection Zone 3	124,900	744,800
Water Protection Zone 2	19,800	342,000
Water Protection Zone 1	92,400	708,500
Off-site Conservation		
Lands available for disposal	43,700	N/A

The proposed Agua Caliente SEZ analysis area is the same as described in Alternative 2 (6,770 acres).

ES.6.8 Preferred Alternative

The BLM has identified Alternative 6: Collaborative-Based REDA as the agency's preferred alternative, because it best meets the following criteria:

- Satisfies statutory requirements (true for all alternatives).
- Reflects what the BLM believes to be the best combination of actions to achieve the stated goals.
- Represents the best solution for the purpose and need as described in Chapter 1.
- Provides the best approach to address the key resource and planning issues.
- Provides resource protection and a viable footprint for energy generation and distribution.
- Includes input from cooperating agencies, collaborating partners, stakeholders, the public, and BLM specialists.

The preferred alternative is the BLM's preliminary preference and does not represent a final BLM decision. The preferred alternative could change between publication of the Draft EIS and Final EIS based on public comments on the Draft EIS, new information, or changes in laws, regulations, or BLM policies. The BLM invites comment on the choice of preferred alternative.

ES.6.9 Alternatives Considered but Eliminated from Detailed Analysis

The range of alternatives developed for RDEP evolved from the issues ascertained through scoping, public outreach, and collaboration with cooperating agencies. The alternatives address a variety of topics, including reuse of disturbed lands, transmission, distributive and utility-scale energy development, and analysis of BLM and other lands. There are a couple of other alternatives that the BLM considered but eliminated from detailed analysis because they did not meet the stated purpose and need (**Section 1.2,** Purpose and Need for the RDEP). These alternatives are summarized below.

Restricting Development to Urban Areas: Suggestions were made to restrict solar and wind energy development to urban areas, such as rooftop solar. The BLM does not have authority to make decisions on non-BLM-administered lands or influence local policies. Likewise, as stated in the purpose and need statement, the BLM needs to identify lands most suitable for renewable energy development. Most BLM lands are located outside of urban areas. While this specific issue has not been incorporated into the EIS as an independent alternative, consideration was given to proximity of available lands to urban areas, load centers, and transmission lines to

promote distributive development. Some of the proposed REDAs are located close to urban areas.

Conservation Management: Comments were made to focus an alternative on instituting conservation measures and implementing demand-side management to reduce electrical demand. While this is a viable action to help meet America's energy needs, it does not respond to the purpose and need for agency action in this EIS. In general, conservation initiatives would be designed to reduce energy consumption levels in order to reduce the need for increased electricity generation capacity. Demand-side management would involve specific actions taken by utilities, their regulators, and other entities to induce, influence, or compel consumers to reduce their energy consumption, particularly during periods of peak demand. These efforts are beyond the scope of the BLM's land management responsibilities.

Other Alternatives Considered but Eliminated: Additional comments were brought up regarding very site-specific implementation-level issues. This EIS is a planning document to identify public lands most suitable for renewable energy development. Site-specific implementation-level analysis would be conducted on an application-by-application basis.

ES.7 SUMMARY OF THE REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

The RFDS identifies the lands in Arizona that are likely most suitable for the development of solar and wind energy resources, and estimates the acreage of those lands required to support renewable energy projects that would not only meet but exceed the Arizona RPS of 15 percent renewable energy by 2025. Arizona, given its abundance of solar energy resources, is expected to be a net exporter of renewable energy, and so it is assumed that by 2025 Arizona will generate renewable energy at a level that is twice the amount required by the RPS. In other words, the RFDS estimates that half of the renewable energy generated will stay in-state, while the other half will be exported to neighboring states such as California. The RFDS is neither a planning decision nor the "No Action Alternative" in the EIS; rather, it serves as a technical supporting analysis to be used as a reference. The full RFDS report is available in **Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona.

The purpose of the RFDS is to inform policy makers, BLM decision makers, the general public, and renewable energy developers. All of the groups have an important role in determining allowable uses on lands and in approving or denying a local project proposal. The RFDS allows them to make comments and decisions on an individual project by taking into account how it would fit into the big-picture, planning-level energy and environmental landscape.

BLM's responsibility for permitting renewable energy production sites is based on production occurring on BLM-administered lands; BLM has no authority to permit renewable energy development on non-BLM-administered lands. The RFDS focuses on ground-based, commercial-scale renewable energy projects; it is recognized that Arizona has potential for rooftop solar and cogeneration of renewable energy with conventional energy production facilities, but these could occur without BLM involvement and, therefore, are excluded from the analysis. However, the RFDS provides parallel analyses for BLM-administered lands and for non-BLM-administered lands throughout the state.

The majority of BLM-administered land that is developable for solar energy projects occurs in the western half of Arizona, with smaller areas identified to the east around Safford and smaller scattered parcels throughout the Tucson Field Office and in the northern portion of the Safford Field Office. Large tracts of land with no known technical or regulatory conflicts are identified along Interstates 8 and 10 to the west of Phoenix, and to the north, south, and west of Highway 389.

Relatively few areas of BLM-administered land are considered developable for wind energy projects across Arizona. These areas occur in several locations within the Arizona Strip Field Office in the northwestern corner of the state, west of Kingman near the California border, an area in the northern portion of the Tucson Field Office, and a scattering of areas in the northern portion of the Safford Field Office, south of Highway 40. No BLM-administered lands were found to contain the highest class of wind resources (Class 7), and only 69 acres were found to contain the second highest class of wind resources (Class 6).

Statistics from the RFDS are summarized in **Table ES-6**, Summary of RFDS Results, below.

ES.8 SUMMARY OF IMPACTS

The BLM assessed the likely direct, indirect, and cumulative impacts on the human and natural environment that could occur from implementing the alternatives summarized in **Section E.6**, Alternatives and described in detail in **Section 2.3**, Alternatives of this EIS. An analysis of the environmental impacts anticipated under each alternative is presented in Chapter 4 and summarized in **Table 2-13**, Summary of Environmental Consequences by Alternative; this analysis examined the potential impacts that would occur on BLM-administered lands in Arizona. In addition to the impact analysis contained in Chapter 4, the BLM evaluated the cumulative impacts of solar and wind renewable energy development on all lands in Arizona regardless of land ownership over the next 20 years when taken in conjunction with other past, present, and reasonably foreseeable future actions in the

Table ES-6
Summary of RFDS Results

Land required to produce 1 GW (solar)	8,000 acres
Land required to produce 1 GW (wind)	28,000 acres (10% of which would be disturbed)
Estimated renewable energy output by 2025	28,642 GWh
Estimated utility scale solar energy maximum production by 2025	9.48 GW
2025 wind energy capacity	0.82 GW
2025 land disturbance (solar, statewide)	76,000 acres
2025 land requirement (wind, statewide)	23,000 acres (10% of which would be disturbed)
2025 land disturbance (solar, BLM lands)	12,000 acres
2025 land requirement (wind, BLM lands)	3,600 acres (10% of which would be disturbed)

GW = gigawatt; GWh = gigawatt-hour
1 GW = 1,000 MW

planning area (see Chapter 5). The contribution of solar and wind development to cumulative impacts would vary by resource.

ES.9 PUBLIC INVOLVEMENT, CONSULTATION, AND COORDINATION

Public involvement, which includes public scoping, is required under NEPA, as defined in CEQ regulations 40 CFR 1500–1508, DOI NEPA regulations 43 CFR 46, and the BLM NEPA Handbook (BLM Handbook H-1790-1), and under FLPMA, as defined in 43 CFR 1610.2 and 1610.4-1 and the BLM Land Use Planning Handbook (BLM Handbook H-1601-1), which provide additional guidance and direction for public involvement.

ES.9.1 Cooperating Agencies

The RDEP engaged multiple cooperating agencies, stakeholders, and the general public for a broad understanding on the desired future renewable energy footprint on federal, tribal, state, and private lands in Arizona. Cooperating agencies are state or federal agencies, or local or tribal governments that enter into formal relationship with the BLM to help develop EISs. Each cooperating agency's level of involvement is at their own discretion and can include participating in issue identification, collecting inventory data, contributing to alternative formulation, and estimating effects of alternatives (BLM Land Use Planning Handbook, H-1601-1, pg. 8). The cooperating agencies on the RDEP include the following:

- Bureau of Reclamation;

- Western Area Power Administration;
- Arizona Game and Fish Department;
- Arizona State Land Department;
- Arizona Department of Environmental Quality;
- Arizona Corporation Commission;
- Central Arizona Water Conservation District; and
- Arizona Department of Water Resources.

ES.9.2 Cultural and Native American Consultations

The BLM initiated consultation with the Arizona State Historic Preservation Officer in April 2010 in accordance with the Protocol for Managing Cultural Resources on Lands Administered by the Bureau of Land Management in Arizona. Consultations will continue through the course of the EIS process to ensure compliance with the National Historic Preservation Act (NHPA) and NEPA. The BLM also initiated contact with the following 23 tribal governments early in the EIS process:

- Ak-Chin Indian Community
- Fort Yuma-Quechan Tribe
- Pascua Yaqui Tribe
- Colorado River Indian Tribes
- Cocopah Tribe
- Yavapai-Prescott Indian Tribe
- Hualapai Tribe
- Hopi Tribe
- White Mountain Apache Tribe
- Havasupai Tribe
- San Carlos Apache Tribe
- Tonto Apache Tribe
- Navajo Nation
- Yavapai-Apache Nation
- Chemehuevi Tribe
- Kaibab Paiute Tribe
- Fort Mojave Tribe
- Pueblo of Zuni
- Gila River Indian Community

- Salt River Pima-Maricopa Indian Community
- Tohono O'odham Nation
- Fort McDowell Yavapai Nation
- San Juan Southern Paiute Tribe

Formal letters were sent to all tribes in Arizona, and presentations have been made at tribal council meetings. BLM continues to remain in contact via in-person meetings, phone calls, and emails, and by responding to individual requests for additional information or meeting presentations.

ES.9.3 Public Involvement Process

The RDEP outreach started with scoping and publication of the Notice of Intent on January 13, 2010 (Federal Register, Vol. 75, No. 8, pg. 1807; both the Notice of Intent and Scoping Report are available on-line at the RDEP Web site: http://www.blm.gov/az/st/en/prog/energy/arra_solar.html). The BLM sought identification of site locations of previously disturbed or utilized lands in addition to identification of issues that might be associated with the RDEP. Local, state, and federal agencies, private companies, and members of the public nominated 42 potential sites. The BLM continued to receive nominations through the Web site, individual letters, and scoping meetings, during which local governments, businesses, and members of the public identified additional potential locations for consideration; to date, an additional 22 sites have been added for consideration (see the nominated sites identified in **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites).

The BLM has provided information on the RDEP project and has sought additional information and data to support alternatives development and analysis from groups that have invited BLM to share information and address public forums regarding the RDEP. The BLM met with these stakeholder groups to identify any additional opportunities for or constraints on the project. The groups included Arizona state agencies, military installations, Arizona utilities, and environmental organizations. A full listing of the groups and agencies consulted are listed in **Chapter 6**, Consultation and Coordination.

The BLM has distributed the Draft EIS to individuals, agencies, and organizations on the RDEP mailing list and to all cooperating agencies for a 90-day public comment period. Following the public comment period, the BLM will review the comments and will revise the EIS if warranted.

As the project moves forward, there will be additional opportunities for public involvement and comment. Public involvement opportunities will be advertised through local news media, the Federal Register, email, the RDEP Web site, and newsletters posted to mailing list recipients. Also, key project

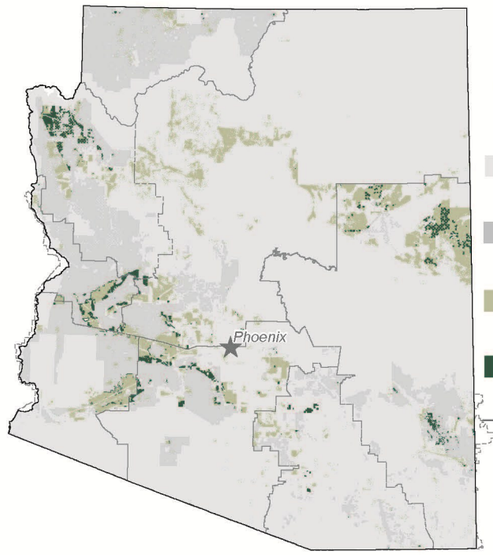
documents will be published on the Web site and made available in individual BLM Arizona Field Offices. Future key public involvement opportunities include the following:

- Publication of a Proposed RMP Amendments and Final EIS. In compliance with BLM planning regulations (43 CFR 1610), a 30-day public protest period will begin following publication. The Governor of Arizona will have 60 days to review the document for consistency with state and local plans and policies. Approval shall be withheld on any portion of the amendment being protested until final action has been completed on such protest. Before such approval is given, there shall be public notice and opportunity for public comment on any significant change made to a proposed plan decision.
- The BLM will accept public input throughout the process. Relevant materials and documents will be made available on the RDEP web site. Dates for the official public comment and protest periods, along with other relevant project dates, also will appear on the Web site.

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REDA - Areas Eliminated from Consideration: Comparison of Baseline Data Used in Alternative Development

Alternative 1: Maximum REDA

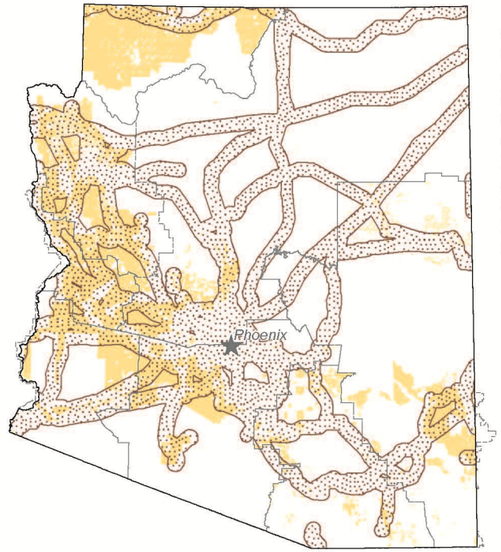


Areas of known resource sensitivity are eliminated from consideration.

- Non-BLM-administered lands with high resource sensitivity (areas eliminated from REDA)
- BLM-administered lands with high resource sensitivity (areas eliminated from REDA)
- Non-BLM-administered lands with low resource sensitivity (areas included in REDA)
- BLM-administered lands with low resource sensitivity (areas included in REDA)
- BLM field office boundary (common to all maps)

Please see Table 2-1 and references for full list of sources for sensitive resource areas.

Alternative 2: Transmission Line and Utility Corridor REDA

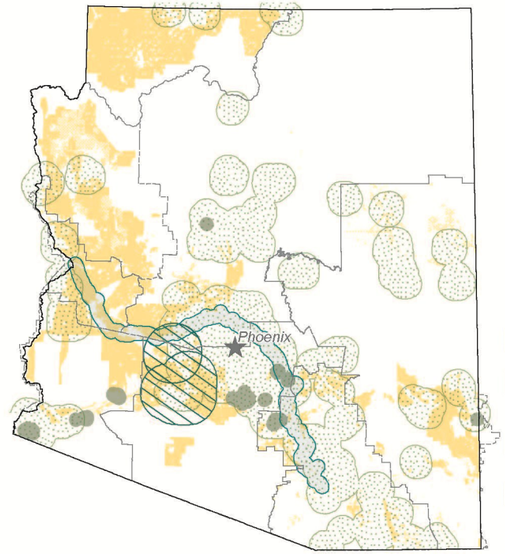


Alternative 2 is the same as Alternative 1, but eliminates REDA not within 5 miles of existing or certified transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, and designated BLM West Wide Energy Corridors.

- Area within 5 miles of transmission line or utility corridor
- BLM-administered lands (common to all maps)

Source: BLM 2011b, POWERmap, powermap.platts.com @2008 Platts, A Division of the McGraw-Hill Companies. Transmission line data are greater than 230 kV and verified with assistance from Arizona Public Service Company, Salt River Project, and Bing Maps.

Alternative 3: Load Offset REDA



Alternative 3 is the same as Alternative 1, but eliminates REDA outside of 10 miles of Arizona incorporated cities, 5 miles around US Bureau of Reclamation (BOR) Central Arizona Project right-of-way and irrigation pumping sites, and 20 miles around Palo Verde Nuclear Power Plant and the town of Gila Bend.

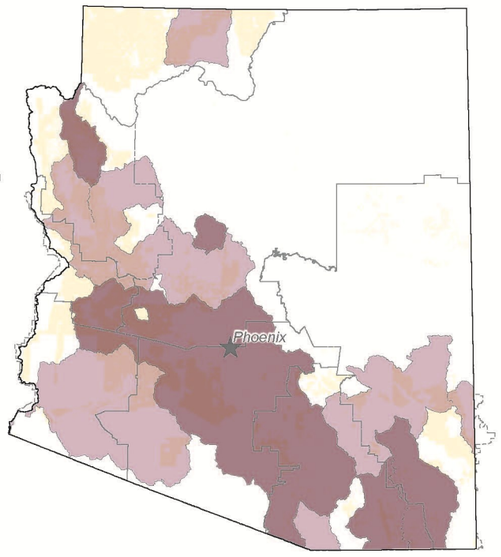
- Area within 10 miles of incorporated city
- Area within 5 miles of US BOR Central Arizona Project right-of-way
- Area within 5 miles of irrigation pumping site
- Area within 20 miles of Palo Verde Nuclear Power Plant or town of Gila Bend

Source: ALRIS 2011a, BLM 2011b, BOR 2011

Alternative 4: Water Conservation and Protection REDA

Alternative 4 is the same as Alternative 1, but categorizes REDA into Water Protection Zones 1, 2, or 3.

- Zone 3 — high protection
- Zone 2
- Zone 1 — low protection



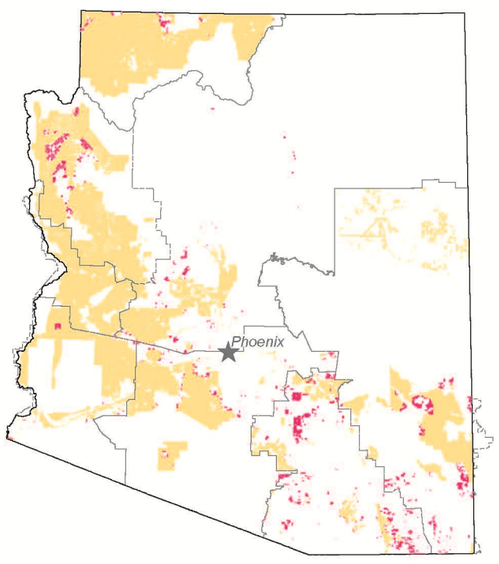
Source: BLM 2011b

Alternative 5: Land Tenure REDA

Alternative 5 is the same as Alternative 1, but only includes REDA that have lands identified for disposal under land use plans and emphasizes exchange of public lands with renewable energy potential for lands of high conservation potential.

Disposal lands are only on BLM-administered lands.

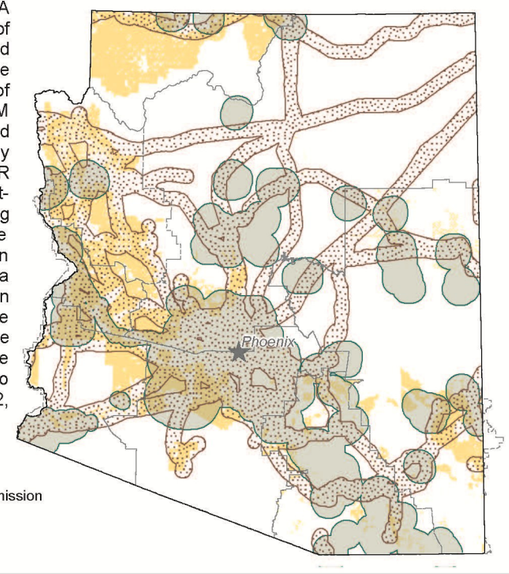
- BLM-administered lands available for disposal



Source: BLM 2011b

Alternative 6: Collaborative-Based REDA

Alternative 6 eliminates REDA that is not within 5 miles of existing or certified transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, designated BLM West Wide Energy Corridors, and US BOR Central Arizona Project right-of-way and irrigation pumping sites. Additionally, Alternative 6 eliminates REDA not within 10 miles of Arizona incorporated cities and within 20 miles of Palo Verde Nuclear Power Plant and the town of Gila Bend. Alternative 6 also categorizes REDA into Water Protection Zones 1, 2, or 3.



- Area within a load center
- Area within 5 miles of transmission line or utility corridor

Source: ALRIS 2011a, BLM 2011b, BOR 2011,

0 50 Miles

N

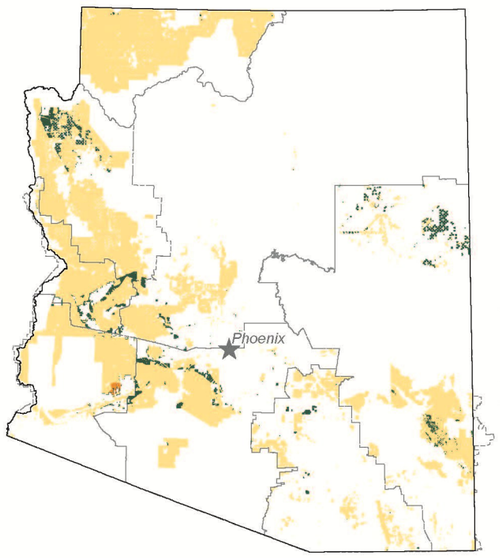
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Figure ES-1

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Comparison of Conceptual Alternatives of REDA on BLM-Administered Lands

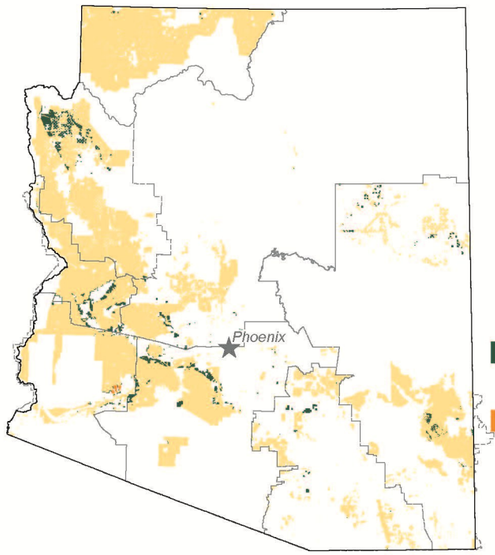
Alternative 1: Maximum REDA



Alternative 1 includes low resource sensitivity areas, RDEP nominated sites, and proposed Agua Caliente Solar Energy Zone (SEZ).

- REDA on BLM-administered lands= 321,500 acres
- Proposed Agua Caliente SEZ= 20,600 acres
- BLM-administered lands outside of REDA (common to all maps)
- BLM field office boundary (common to all maps)

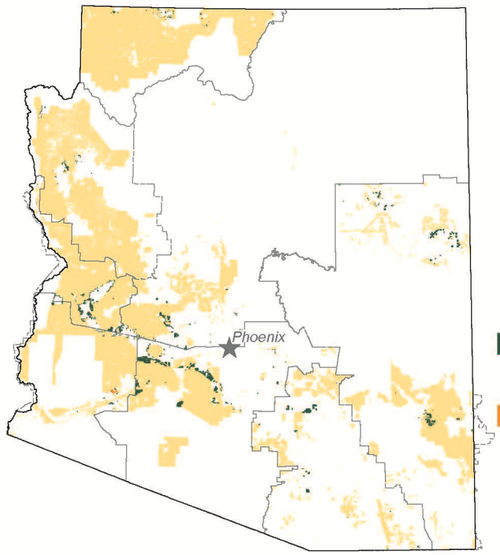
Alternative 2: Transmission Line and Utility Corridor REDA



Alternative 2 is the same as Alternative 1, but includes REDA within 5 miles of existing or certified transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, and designated BLM West Wide Energy Corridors.

- REDA on BLM-administered lands= 218,600 acres
- Proposed Agua Caliente SEZ= 6,770 acres

Alternative 3: Load Offset REDA

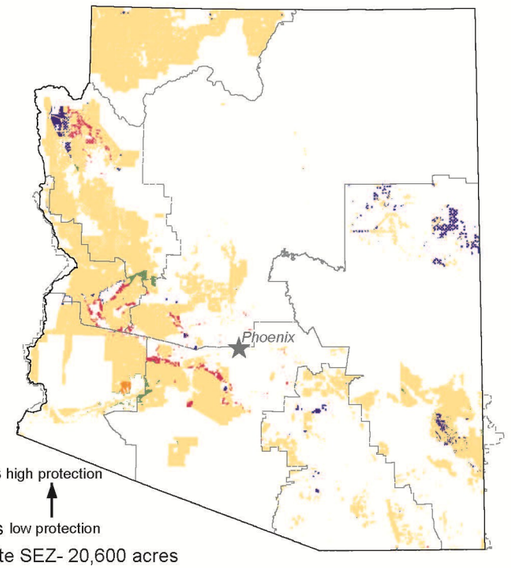


Alternative 3 is the same as Alternative 1, but includes REDA within 10 miles of incorporated cities in Arizona, 5 miles of US Bureau of Reclamation Central Arizona Project right-of-way and irrigation pumping sites, and 20 miles of Palo Verde Nuclear Power Plant and the town of Gila Bend.

- REDA on BLM-administered lands= 129,800 acres
- Proposed Agua Caliente SEZ= 2,760 acres

Alternative 4: Water Conservation and Protection REDA

Alternative 4 is the same as Alternative 1, but categorizes REDA into Water Protection Zones 1, 2, or 3. RDEP nominated sites are considered Zone 1.



REDA on BLM-administered lands= 321,500 acres

- Zone 3=130,700 acres
- Zone 2=47,900 acres
- Zone 1=142,900 acres

high protection ↑ low protection

- Proposed Agua Caliente SEZ- 20,600 acres

0 50 Miles

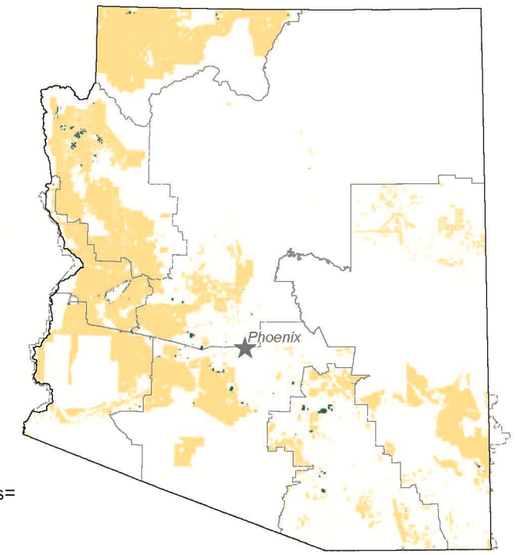
N

BLM administers 12.1 million acres of land in Arizona.

Alternative 5: Land Tenure REDA

Alternative 5 is the same as Alternative 1, but only includes REDA that have lands identified for disposal under land use plans. Alternative 5 emphasizes exchange of public lands with renewable energy potential for lands of high conservation potential and does not include the proposed Agua Caliente SEZ.

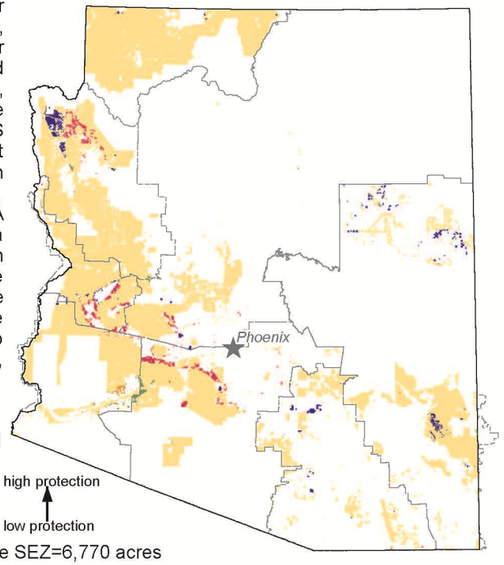
Disposal lands are only on BLM-administered lands.



- REDA on BLM-administered lands= 43,700 acres

Alternative 6: Collaborative-Based REDA

Alternative 6 includes REDA within 5 miles of existing or certified transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, designated BLM West Wide Energy Corridors, and US BOR Central Arizona Project right-of-way and irrigation pumping sites. Additionally, Alternative 6 includes REDA within 10 miles of Arizona incorporated cities and within 20 miles of Palo Verde Nuclear Power Plant and the town of Gila Bend. Alternative 6 also categorizes REDA into Water Protection Zones 1, 2, or 3.



REDA on BLM-administered lands= 237,100 acres

- Zone 3=124,900 acres
- Zone 2=19,800 acres
- Zone 1=92,400 acres

high protection ↑ low protection

- Proposed Agua Caliente SEZ=6,770 acres

Source BLM 2011a

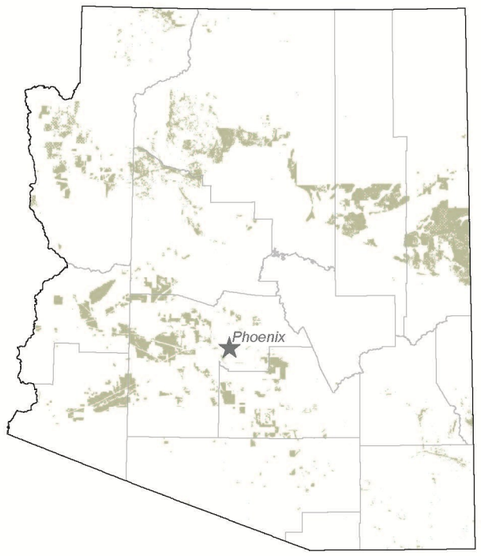
February 2012. No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.

Figure ES-2

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Comparison of Conceptual Alternatives of REDA on Non-BLM-Administered Lands

Alternative 1: Maximum REDA

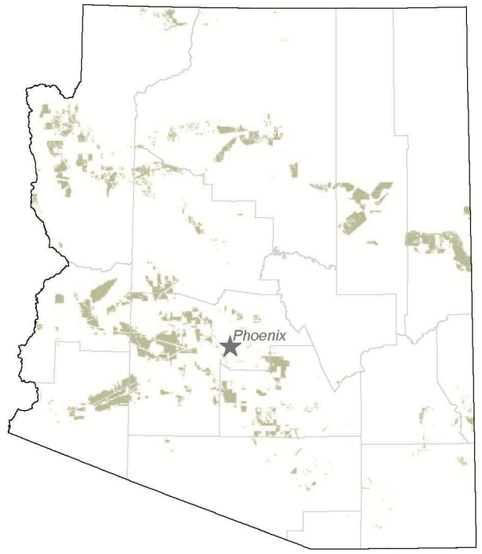


Alternative 1 includes low resource sensitivity areas and RDEP nominated sites.

REDA on non-BLM-administered lands= 2,367,900 acres

County boundary (common to all maps)

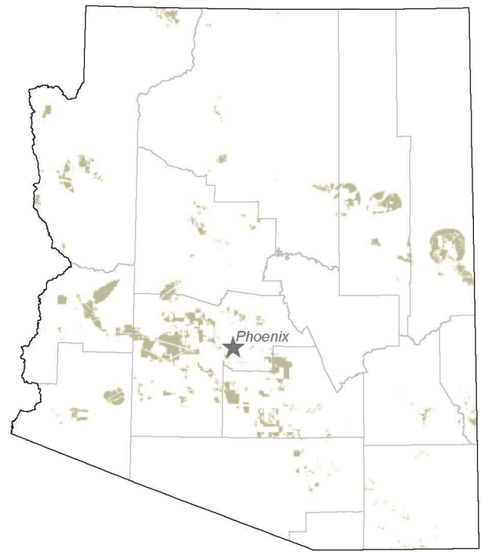
Alternative 2: Transmission Line and Utility Corridor REDA



Alternative 2 is the same as Alternative 1, but includes REDA within 5 miles of existing or certified transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, and designated BLM West Wide Energy Corridors.

REDA on non-BLM-administered lands= 1,680,600 acres

Alternative 3: Load Offset REDA

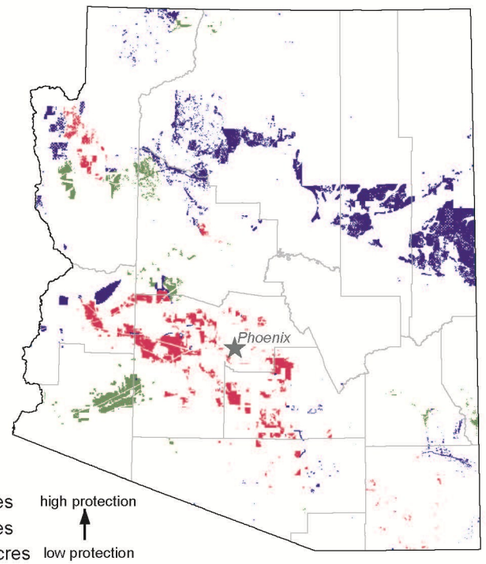


Alternative 3 is the same as Alternative 1, but includes REDA within 10 miles of Arizona incorporated cities, 5 miles of US Bureau of Reclamation Central Arizona Project right-of-way and irrigation pumping sites, and 20 miles of Palo Verde Nuclear Power Plant and the town of Gila Bend.

REDA on non-BLM-administered lands= 1,121,500 acres

Alternative 4: Water Conservation and Protection REDA

Alternative 4 is the same as Alternative 1, but categorizes REDA into Water Protection Zones 1, 2, or 3. RDEP nominated sites are considered Zone 1.



REDA on non-BLM-administered lands= 2,367,900 acres

Zone 3=760,200 acres

Zone 2=386,500 acres

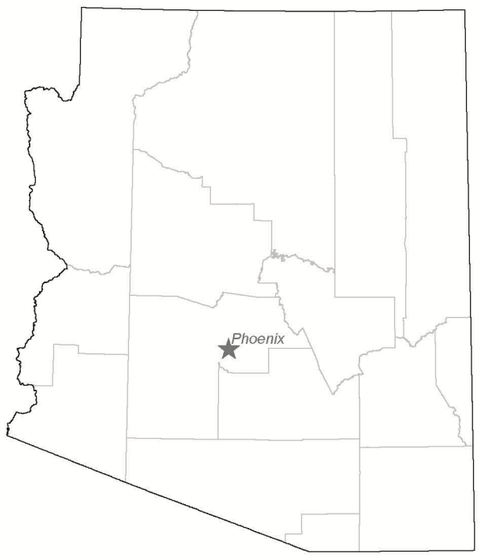
Zone 1=1,221,200 acres

high protection

low protection

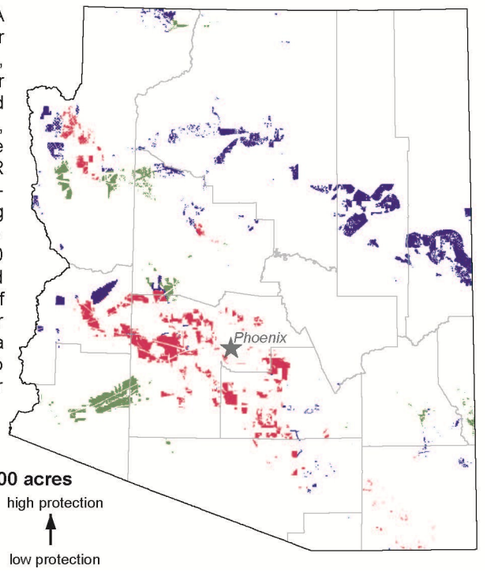
Alternative 5: Land Tenure REDA

Disposal lands are only on BLM-administered lands.



Alternative 6: Collaborative-Based REDA

Alternative 6 includes REDA within 5 miles of existing or certified transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, designated BLM West Wide Energy Corridors, and US BOR Central Arizona Project right-of-way and irrigation pumping sites. Additionally, Alternative 6 includes REDA within 10 miles of Arizona incorporated cities and within 20 miles of Palo Verde Nuclear Power Plant and the town of Gila Bend. Alternative 6 also categorizes REDA into Water Protection Zones 1, 2, or 3.



REDA on non-BLM-administered lands= 1,795,300 acres

Zone 3=744,800 acres

Zone 2=342,000 acres

Zone 1=708,800 acres

high protection

low protection

0 50 Miles

N

Arizona is 72.9 million acres.
No decisions will be made on non-BLM-administered lands.

Source BLM 2011a

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Figure ES-3

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CHAPTER 1
INTRODUCTION

1.1 OVERVIEW

Arizona has a wealth of renewable energy resources, especially for those technologies that rely on solar radiation and wind (Black and Veatch 2007). The United States (U.S.) Department of the Interior (DOI), Bureau of Land Management (BLM) manages over 12 million surface acres of public lands in Arizona. Wind and solar projects on public lands are administered by the BLM lands and realty program through right-of-way (ROW) grants in accordance with land use plans.

Renewable Arizona Fast Facts

Suitable solar resource potential: 57% of the state

Suitable wind resource potential: 2% of the state

By 2025, at least 15 percent of Arizona's electrical demand will be met with renewable energy

Total BLM-administered lands in Arizona: 12.2 million acres

See **Figure 1-1**, Statewide Solar and Wind Potential

BLM Arizona has prepared this environmental impact statement (EIS) to identify which lands across Arizona are most suitable for the development of renewable energy and to consider establishing a baseline set of environmental protection measures that would apply to such projects on public lands.

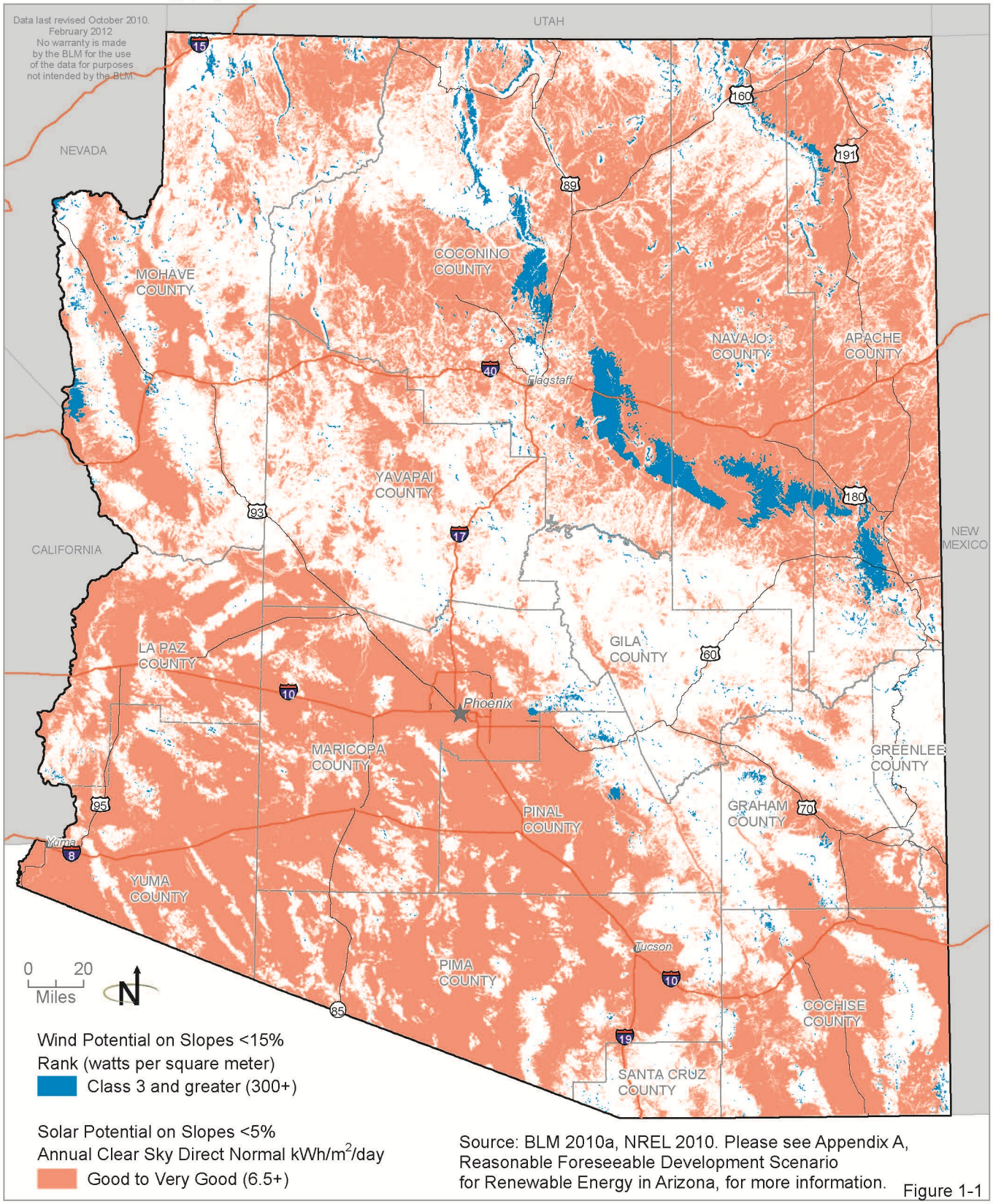
The Restoration Design Energy Project (RDEP) is a project of BLM Arizona that supports the Secretary of the Interior's goals to build America's new energy future and to protect and restore treasured landscapes. The intent of the RDEP planning effort is to identify Renewable Energy Development Areas (REDAs) and a Solar Energy Zone (SEZ) for Arizona that include disturbed sites such as brownfields, landfills, retired agricultural lands, or abandoned mines, and lands with low resource sensitivity and few environmental conflicts. Objectives that will help determine the success of the planning effort are to identify REDAs and a SEZ that:

- Are accessible and allow for easier or more efficient building of renewable energy facilities;
- Are close enough to existing transmission facilities as to make it more efficient and cost effective to bring the energy on-line and deliver it to the people who need it;

Statewide Solar and Wind Potential

The entire state receives enough solar radiation for development (NREL 2010), with an annual Direct Normal Irradiance of 6.5 or higher. Areas with slopes of 5% or greater were eliminated as these areas are usually considered undevelopable for solar energy projects.

Wind resource classes three or greater (NREL 2010) are considered the most developable. Areas with slopes of 15% or greater were eliminated as these areas are usually considered economically unfeasible for wind energy projects.



Source: BLM 2010a, NREL 2010. Please see Appendix A, Reasonable Foreseeable Development Scenario for Renewable Energy in Arizona, for more information.

Figure 1-1

Renewable energy comes from natural resources whose supplies are regenerative and virtually inexhaustible, including sunshine, wind, water, vegetation, and the heat of the earth. The Restoration Design Energy Project focuses on solar and wind resources.

- Will provide enough public land acreage (described in **Appendix A**, Reasonably Foreseeable Development Scenario [RFDS] for Renewable Energy in Arizona) to contribute to meeting the renewable energy demand of Arizona (based on the Arizona Renewable Portfolio Standard [RPS]), and provide flexibility for micro-siting and mitigation; and
- Will include lands previously identified for disposal in existing BLM land use plans to incentivize development on REDAs and to conserve important resources.

Throughout project development, the BLM has engaged cooperating agencies, state and local governments, tribes, and stakeholders in order to obtain broad consensus on the desired future renewable energy footprint in Arizona and to inform renewable energy developers in their siting of projects throughout the state. Decisions from this project will apply only to public lands administered by the BLM. BLM resource management plans (RMPs) in Arizona would be amended to adopt the selected alternative.

The RDEP, funded by the American Recovery and Reinvestment Act of 2009, supports the Secretary of the Interior's goals to build America's new energy future and to protect and restore treasured landscapes. The RDEP focuses on renewable resources with the highest potential for development in Arizona, specifically wind and solar in areas with low resource sensitivity, but recognizes that other future renewable energy technologies that require a land base for development may be suitable in those areas as well (see **Appendix A**, Reasonably Foreseeably Development Scenario for Renewable Energy in Arizona, for full discussion of assumed technologies).

1.2 PURPOSE AND NEED FOR THE RDEP

A growing demand for energy in the western U.S. combined with applicable laws, orders, and policies that encourage the DOI and the BLM to facilitate renewable energy siting and production has created a need for BLM Arizona to consider updating and amending their land use plans (see **Section 1.3**, BLM Guidance for the RDEP). Siting renewable energy projects is complex and multifaceted, requiring the consideration of many variables, including topography, distance to transmission and load, land ownership patterns and availability, tribal concerns, and environmental and cultural resource constraints. Current land use plans generally do not address these factors or provide guidance on where development should occur. Therefore, under current plans, processing of applications can take a long time to adequately evaluate the site location, to conduct environmental and cultural reviews, to develop appropriate mitigation measures, to effectively collaborate with stakeholders, and, in some cases, to prepare a land use plan amendment.

The purpose of the RDEP is to conduct smart, statewide planning to foster environmentally responsible production of renewable energy and to allow the permitting of future renewable energy development projects to proceed in a more efficient and standardized manner. The RDEP would amend land use plans to identify geographic areas best suited for renewable energy, establish land reuse goals, and identify design features to protect resource values and uses.

While RDEP would further the BLM's ability to meet the mandates of Executive Order (EO) 13212, Actions to Expedite Energy-Related Projects (Federal Register, Volume 66, page 28357, May 22, 2001) and the Energy Policy Action of 2005, it also has been designed to meet the requirements of Secretarial Order 3285A1 related to identifying areas best suited for renewable energy (Secretary of the Interior 2010).

1.3 BLM GUIDANCE FOR THE RDEP

Agency guidance for the action comes from the following orders, mandates, and laws, which require the BLM, as part of the DOI, to facilitate renewable energy development:

- The Federal Land Policy and Management Act (FLPMA) of 1976, as amended, is the BLM's basic authority. FLPMA Title V, Rights-of-Way, allows the BLM to grant, issue, or renew ROWs for pipelines, transmission, communication sites, roads, highways, or other types of facilities or transportation systems as may be needed. Sections that relate to disposing of land include Sections 102, 205, 206, and 207 for land exchanges. All of these sections contain provisions to facilitate and expedite land exchanges by establishing uniform rules and regulations for appraisals and to ensure that the public interest will be well served by making the exchange. Section 203 of the Act addresses the sale of BLM-administered lands, noting that the sale must meet certain criteria, including serving important public objectives and that the lands be difficult and uneconomic to manage and not suitable for management by another federal agency.
- Secretarial Order 3285 states a policy goal of identifying and prioritizing specific locations best suited for large-scale production of solar energy on public lands and requires DOI agencies to work with individual states, tribes, local governments, and other interested stakeholders, including renewable energy generators and transmission and distribution utilities, to identify appropriate areas for generation and necessary transmission; to develop best management practices (BMPs) for renewable energy and transmission projects on public lands to ensure the most environmentally responsible

development and delivery of renewable energy; and to establish clear policy direction for authorizing the development of solar energy on public lands.

- The Energy Policy Act of 2005 (Public Law 109-58) encourages the development of renewable and alternative energy resources, including solar and wind energy, as part of an overall strategy to develop a diverse portfolio of domestic energy supplies. Section 211 of the Act calls for the Secretary of the Interior to have approved non-hydropower renewable energy projects located on public lands, where appropriate, with a generation capacity of at least 10,000 megawatts (MW) of electricity by 2015.
- President Obama's new energy plan for America outlines plans to promote renewable energy in the United States, including a national RPS to require that 10 percent of electricity consumed in the U.S. is derived from clean, sustainable energy sources, such as solar, wind, and geothermal, by 2012.
- The State of Arizona has established an RPS of 15 percent by 2025. In November 2006, the Arizona Corporation Commission (ACC) adopted final rules to expand the state's RPS; by 2012, 30 percent of the 15 percent RPS requirement (or 4.5 percent) must come from distributed renewable resources. One half of the distributed renewable energy requirement must come from residential applications and the remaining half from non-residential, non-utility applications. Extra credit multipliers may be earned for early installation of certain technologies. Utilities subject to the Renewable Electricity Standard must submit compliance and implementation plans annually to the ACC, and a yearly compliance schedule has been adopted. Additional tariff rules and other renewable energy mandates also support renewable energy development.
- BLM Arizona has developed a multi-year strategic plan that includes goals for sustainable energy use. These goals provide long-term direction that guide priority setting and support community use of BLM lands. See **Section 1.4.3**, BLM Arizona Strategic Goals, for more details.

1.4 THE RDEP'S RELATIONSHIP TO NATIONAL AND STATEWIDE BLM POLICIES AND PROGRAMS

Numerous federal and state BLM initiatives are currently underway to promote renewable energy development. Overviews of key initiatives and the methods by which the RDEP would coordinate with these efforts are included below.

1.4.1 Solar Energy Development Programmatic EIS

The Solar Energy Development Programmatic EIS (PEIS), currently being prepared by the U.S. Department of Energy (DOE) and the BLM, will assess environmental impacts associated with the development and implementation of agency-specific programs that would facilitate environmentally responsible, utility-scale solar energy development in six western states: Arizona, California, Colorado, New Mexico, Nevada, and Utah.

On the basis of the analyses presented in the Solar PEIS, the BLM anticipates making the following land use planning decisions that will establish the foundation for a comprehensive Solar Energy Program in the six-state study area:

Design features are those specific means, measures, or practices that make up the proposed action and alternatives, and can be measures that would reduce or eliminate adverse effects. Standard operating procedures, stipulations, and best management practices are usually considered design features. If means, measures, or practices are not incorporated into the proposed action or alternatives, then they are considered mitigation measures.

1. Land use plan amendments that identify exclusion areas for utility-scale solar energy development in the six-state study area;
2. Land use plan amendments that identify areas potentially available for utility-scale solar energy development outside of SEZs in the six-state study area (i.e., variance areas);
3. Land use plan amendments that identify priority areas for solar energy development that are well suited for utility-scale production of solar energy (i.e., SEZs); and
4. Land use plan amendments that establish design features (i.e., mitigation requirements) for solar energy development on public lands to ensure the most environmentally responsible development and delivery of solar energy (some design features may be SEZ-specific, as necessary).

The proposed SEZs are defined by the BLM as areas within which the BLM will prioritize and facilitate utility-scale production of solar energy and associated transmission infrastructure development. SEZs should be relatively large areas that provide highly suitable locations for utility-scale solar development: locations where solar development is economically and technically feasible, where there is good potential for connecting new electricity-generating plants to the transmission distribution system, and where there is generally low resource conflict.

There are 17 proposed SEZs being carried forward in the Solar PEIS study area, two of which are in Arizona – the Brenda SEZ and Gillespie SEZ. The two proposed SEZs in Arizona encompass 6,465 acres (**Figure 1-2**, Arizona Solar Energy Zones from the Solar PEIS). The proposed SEZs were determined by finding areas with suitable slope, proximity to roads and transmission lines or designated corridors, and containing at least 2,000 acres of BLM-administered public lands. Sensitive lands, wilderness, and other high-conservation-value lands as well as lands with conflicting uses were excluded. As the Solar PEIS is finalized, it may modify the boundaries of the proposed SEZs or remove them, but no new SEZs will be proposed through the Solar PEIS. The Record of Decision (ROD) for the Solar PEIS is anticipated for September 2012.

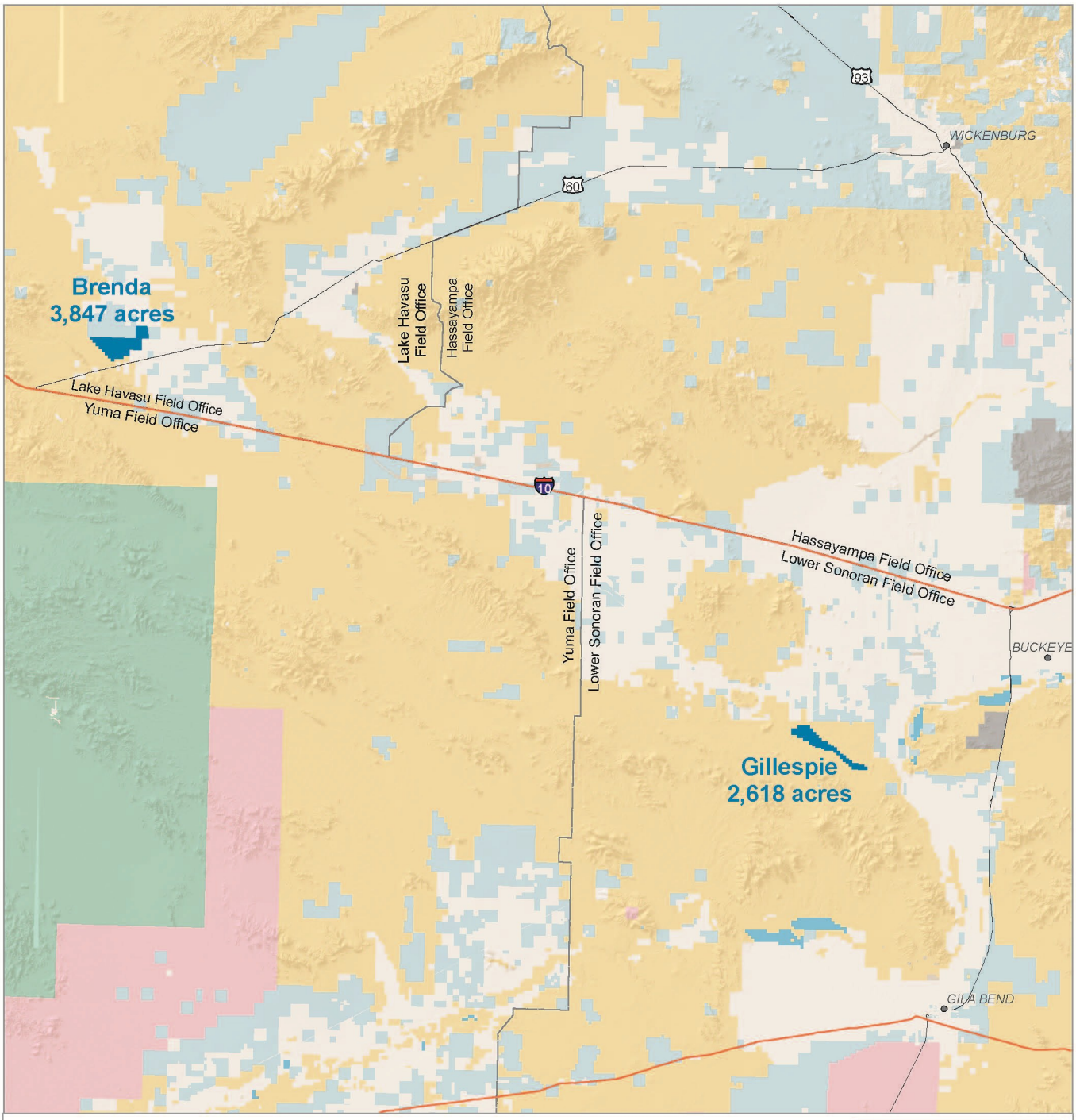
The Solar PEIS effort and the RDEP are being closely coordinated as both are related to making land use planning decisions for the most suitable areas to develop solar energy facilities. The RDEP is a "step down" from the national level to focus on specific issues and areas in Arizona. Upon issuance of the ROD for the Solar PEIS, land use plans in Arizona will be amended to incorporate the land use plan decisions described above. The RDEP effort seeks to further refine and build upon the decisions being analyzed in the Solar PEIS for utility-scale solar, including the following:

- The RDEP will identify those areas most suitable for renewable energy development within the variance areas identified by the Solar PEIS (i.e., a REDA). Identification of a REDA could fulfill the variance process requirements proposed in variance areas through the Supplement to the Draft Solar PEIS (BLM and DOE 2011). This would allow utility-scale solar energy developers a more streamlined process in these highly suitable areas.
- The RDEP would refine and build upon the design features being proposed in the Solar PEIS for conditions relevant to wind and solar development in Arizona.
- In accordance with the identification protocols for new SEZs (as identified in the Supplement to the Draft Solar PEIS), the RDEP is proposing and analyzing an additional SEZ for Arizona.

A summary of the scope of each of the two projects is provided in **Table 1-1**, Comparison of the Scope of the Solar PEIS and the RDEP.

Arizona Solar Energy Zones from the Solar PEIS

The Solar PEIS proposes to identify two Solar Energy Zones (SEZs) in Arizona: Brenda and Gillespie.



Source: BLM 2011b, BLM and DOE 2011

0 5 Miles

N

February 2012
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.

Solar PEIS SEZ

Surface Administration

BLM-administered lands

State

Private, other

US Fish and Wildlife Service

Military

State Wildlife Area

Local or State Park

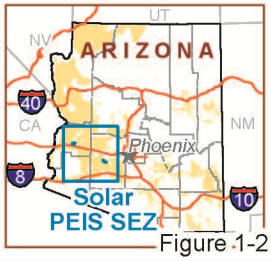


Figure 1-2

Table 1-1
Comparison of the Scope of the Solar PEIS and the RDEP

Solar PEIS	RDEP[1]
Applies to: Utility-scale solar energy developments (≥20 MW) ONLY	Applies to: Solar-based energy technologies and wind energy technologies
• Allocations: - Exclusion Areas - Variance Areas (Variance Process required) - SEZs – two in Arizona: ▪ Brenda ▪ Gillespie • Solar Energy Development Program Policies & Procedures • Solar Energy Development Program Design Features	• Identify REDAs within Variance Areas • Identify the Agua Caliente SEZ • Wind Energy Program policies and procedures from the Wind Energy Program ROD • Goals, Management Actions, and Design Features for solar and wind renewable energy development regardless of scale, land reuse, and remediation of disturbed sites

1.4.2 Wind Programmatic EIS

BLM Arizona did not adopt the decisions of the Wind PEIS. The RDEP proposes amending BLM Arizona land use plans in areas that have wind resources with the Wind Energy Program decisions.

In 2005, the BLM prepared a comprehensive PEIS to guide wind energy development in 11 western states: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming (BLM 2005b). The U.S. DOE cooperated in the preparation of the Wind PEIS in support of the BLM's proposed action. The decision established policies and BMPs for the administration of wind energy development activities and established minimum requirements for mitigation measures. Fifty-two BLM land use plans were amended to adopt the new program; no plans in Arizona were amended as a result of the Wind PEIS. The RDEP analyzes the Wind Program policies, BMPs, and land use plan decisions relevant to Arizona and will decide whether to adopt the policies, BMPs, and land use plan decisions for Arizona. The RDEP will identify areas best suited for wind energy development for inclusion in the REDAs and will consider any additional design features, management actions, and/or BMPs to include for wind energy projects in Arizona.

1.4.3 BLM Arizona Strategic Goals

Energy Strategy

Recent interest in renewable energy development in Arizona, and in the West in general, has led to a large interest in the use of public lands for siting of renewable energy projects. BLM Arizona has developed a BLM Arizona Statewide Energy Strategy to help manage the need for renewable energy locations on public lands, including processing of existing

[1] The ROD resulting from the Solar PEIS will amend Arizona land use plans for utility-scale solar energy development. All of the decisions included in the Solar PEIS ROD would apply and would be implemented.

applications, participation in the Solar PEIS, and the development of the RDEP. Some of the goals of the Energy Strategy include participating with state and private entities to develop renewable energy strategies for all of Arizona, responsively processing renewable energy applications, and developing a plan for renewable energy developments in an environmentally responsible manner.

Other BLM Arizona Strategies

In addition to the Energy Strategy, BLM Arizona has established other strategies to provide long-term direction and priority setting for BLM Arizona. The strategies reflect current DOI and BLM strategic direction, knowledge of BLM Arizona workload, expected funding, and citizen expectations. The main goals include the following:

- Promote the sustainability of public lands by directing renewable energy onto lands with low resource conflicts;
- Be effective stewards of heritage resources by engaging government-to-government consultation with tribal governments and thoroughly considering cultural resources in environmental analysis; and
- Support community use of BLM-administered lands, especially through promotion of renewable energy.

1.5 DECISIONS TO BE MADE BY THE RDEP

As discussed above, the RDEP process includes: (1) analyzing lands and realty program planning actions related to identifying REDAs and a SEZ, and (2) analyzing goals, management actions, and design features for renewable energy development ROWs.

Renewable energy developments proposed outside of a REDA or SEZ would be considered on a case-by-case basis using applicable national policy direction and guidance from existing land use plan decisions (see **Section 1.5.3**, Requirements for Further Environmental Analysis).

1.5.1 Decisions on the REDA

The Arizona Strip Field Office RMP (BLM 2008d), Phoenix Resource Area RMP (BLM 1988; Lower Sonoran portion of planning area), Bradshaw-Harquahala RMP (BLM 2010j), Safford RMP (BLM 1991), Kingman Resource Area RMP (BLM 1995a), Yuma RMP (BLM 2010g), and Lake Havasu RMP (BLM 2007a) will be amended to:

- Identify REDAs for renewable energy development;
- Establish goals, objectives, and management actions for renewable energy development;

- Identify REDA land disposal criteria for future land disposal allocation decisions and disposal actions, including land exchanges and sales; and
- Identify terms and conditions, including design features and mitigation measures to minimize environmental impacts and that can be used to guide development at the local level (see **Appendix B**, Design Features and Best Management Practices).

Disturbed Lands and Nominated Parcels

The RDEP emphasizes the reuse of previously disturbed or developed lands as a method for reducing impacts on sensitive resources.

A key component of the RDEP is emphasizing the reuse of previously disturbed or developed lands that, after remediation or site preparation, may be suitable for renewable energy development, thereby reducing impacts on sensitive resources. With this in mind, BLM Arizona and members of the public identified 64 previously utilized sites on BLM-administered, state, municipal, and private lands; site types include gravel pits, mine sites, retired agricultural lands, landfills, isolated parcels that have been disturbed, and abandoned unauthorized airstrips (see **Figure 1-3**, RDEP Nominated Sites and **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites. The site boundaries generally follow ownership patterns or other geographic references. All lands in the boundaries may or may not have been disturbed depending on the use and how the site was nominated.

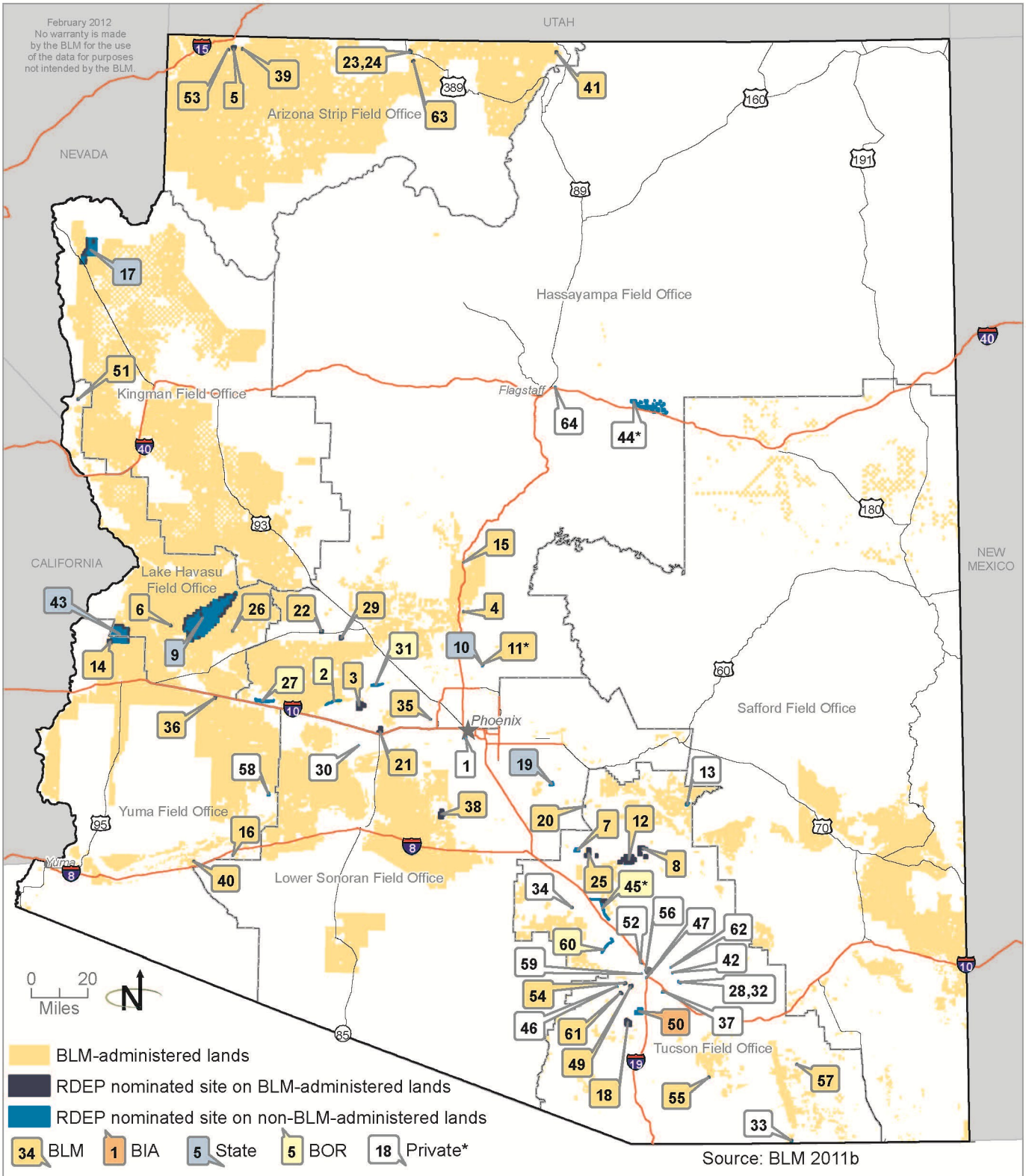
As discussed in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, all nominated sites are identified as REDAs for analysis along with other lands with low resource sensitivity. To further plan for and support reuse of disturbed lands, the RMPs would also be amended to:

- Establish goals, objectives and management actions for land reuse and sustainability practices; and
- Establish goals, objectives, and management actions for remediation of previously disturbed lands.

Nominated sites not on BLM-administered public lands will not be subject to these decisions, but these sites are considered part of the planning and analysis area to help BLM decision-making on adjacent suitable public lands (see **Section 1.6.1**, Scope of the REDA Analysis). **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites provides analysis of all nominated sites. This analysis will help inform state, tribal, and local governments and agencies and serve as a resource for the general public, policy makers, and energy planners that are considering renewable energy projects on these sites.

RDEP Nominated Sites

Based on an extensive public outreach process, the BLM and public identified 64 suitable previously disturbed sites on BLM-administered, state, municipal, private and other federal lands.



Please see Appendix C, Table 1-1 RDEP Nominated Site Summaries, for RDEP nominated sites' names corresponding to the numbers on this figure. Site 48 (not shown on map) is comprised of sites 49, 54, and 61. *Sites have multiple ownerships, majority ownership is displayed. The number of sites per landownership type is displayed.

Figure 1-3

1.5.2 Decisions on the SEZ

In addition to identifying REDAs, the RDEP is serving as a step-down process to the Solar PEIS for utility-scale solar development (see **Section 1.4.1**, Solar Energy Development Programmatic EIS). As such, the BLM is also proposing to identify a SEZ to facilitate the development of utility-scale solar projects. As discussed in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, the proposed SEZ is called Agua Caliente and is located in the BLM's Yuma Field Office planning area of southwest Arizona. Based on the EIS analysis, the BLM may decide to carry forward the proposed Agua Caliente SEZ and would then amend the Yuma RMP to:

- Identify the Agua Caliente SEZ;
- Establish renewable energy goals, objectives, management actions, and design features for application in the SEZ;
- Identify SEZ-specific design features;
- Change the visual resource management (VRM) designations in the SEZ from VRM Class III to Class IV; and
- Remove the Special Recreation Management Area designation from within the Agua Caliente SEZ.

The BLM Arizona State Director has filed notice to segregate the proposed Agua Caliente SEZ study area (20,776 acres) from appropriation under the public land and mining laws for a period of two years. The purpose of the segregation is to protect this area from encumbrances, particularly mining claims, while the study area is evaluated in this EIS.

1.5.3 Requirements for Further Environmental Analysis

This EIS will not eliminate the need for site-specific environmental review for future individual renewable energy development proposals; the BLM will make individual decisions on a case-by-case basis whether or not to authorize individual renewable energy development projects in conformance with the amended land use plan on the basis of this EIS. The BLM retains the discretion to deny solar and wind ROW applications based on site-specific issues and concerns, even in those areas available or open for application in the existing land use plan.

In cases where a broad policy, plan, program, or project will later be translated into site-specific projects, subsequent analyses are referred to as "tiered" analyses. Tiering refers to the coverage of general matters in a broader EIS, such as state-wide program or policy statements, with subsequent narrower EISs or environmental assessments (EAs), such as site-specific proposal documents, incorporating by reference the general discussions and concentrating solely on the issues specific to the subsequent EIS or EA (40 Code of Federal Regulation [CFR] 1508.28). Site-specific

environmental reviews for renewable energy development projects that begin after the ROD for this EIS is finalized will be tiered to this EIS.

1.6 SCOPE OF ANALYSIS

The RDEP has a programmatic focus. The EIS provides the BLM, the State of Arizona, county and local governments, tribal governments, utility companies, the renewable energy industry, and the public with a better understanding of the environmental and economic issues associated with developing renewable energy in Arizona.

1.6.1 Scope of the REDA Analysis

The scope of the EIS encompasses a wide range of renewable energy resources and technologies, including solar-based technologies and wind energy technology.[2] For a detailed discussion of what types of technologies are assumed, see **Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona.

Along with the BLM-administered lands with low resource sensitivity, the 64 nominated sites described earlier are included as part of the REDAs. As the BLM does not have jurisdiction to apply management decisions to non-BLM-administered lands, the RDEP land use and management decisions only apply to BLM-administered lands. While any decisions made related to renewable energy development within the REDAs would apply only to the BLM-administered nominated sites, non-BLM-administered sites were also included in the RDEP planning and analysis areas. This analysis will help inform state, tribal, and local governments and agencies and serve as a resource for the general public, policy makers, and energy planners that are considering renewable energy projects on these sites. Additional suitable disturbed lands may continue to be identified over time and may be considered in this or subsequent analyses.

1.6.2 Scope of the SEZ Analysis

In addition to the programmatic analysis for the REDAs, the BLM conducted a statewide review and identified the proposed Agua Caliente SEZ as a candidate for analysis. The screening criteria focused on large blocks of BLM-administered lands that have limited sensitive resources, are located near existing solar energy developments, were previously disturbed, and are near existing road and transmission infrastructure. This EIS provides in-depth environmental analysis on the proposed Agua Caliente SEZ as a

[2] Geothermal resources are classified as a fluid mineral and are administered under separate laws and regulations from the lands and realty program and are not part of the RDEP project and environmental analysis. In December 2008, the BLM signed the ROD and RMP Amendments for geothermal leasing in the Western U.S. (BLM 2008b). This decision amended all of the land use plans in Arizona to provide the appropriate allocations, stipulations, and procedures to facilitate the leasing of geothermal resources in the state.

location suitable for utility-scale solar energy development.[3] The primary purpose of this more rigorous analysis is to provide documentation from which the BLM can tier future project authorizations, thereby limiting the required scope and effort of project-specific National Environmental Policy Act (NEPA) analyses. The BLM would complete a site-specific environmental review of all solar energy ROW applications in accordance with NEPA prior to issuing a ROW authorization. All future projects proposed in the Agua Caliente SEZ could tier to the analysis in this EIS. The extent of this tiering, however, would vary by project, as would the necessary level of NEPA documentation.

1.6.3 Geographic Information System Data and Graphics

Data from geographic information systems (GIS) have been used in developing acreage calculations and for generating many of the figures. Calculations in this EIS are rounded and are dependent upon the quality and availability of data. Data were collected from a variety of sources, including the BLM, collaborative partners, stakeholders, and cooperating agencies. Given the scale of the programmatic analysis, the compatibility constraints between datasets, and lack of data for some resources, all calculations are approximate and serve for comparison and analytic purposes only. Likewise, the figures are provided for illustrative purposes and subject to the limitations discussed above. Detailed, site-specific information is available from local BLM offices. BLM may receive additional GIS data; therefore, the acreages may be recalculated and revised at a later date.

1.7 LAWS AND REGULATIONS THAT APPLY TO THE RDEP

This EIS complies with the National Environmental Policy Act of 1969, as amended; the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA, outlined in Part 40 of the Code of Federal Regulations (40 CFR Parts 1500-1508) and DOI NEPA regulations at 43 CFR 46; DOI and BLM policies and manuals (BLM NEPA Handbook H-1790-1; BLM 2008c); and the BLM Land Use Planning Handbook H-1601-1 (BLM 2005c).

Other federal laws applicable to the RDEP EIS include, but are not limited to, the following:

- FLPMA;
- Clean Water Act;
- Energy Policy Act of 2005;
- Endangered Species Act;

[3] For the purpose of the RDEP, "utility-scale" solar energy development is defined as projects capable of generating 20 MW or greater. Viable utility-scale solar technologies to be deployed over the next 20 years include parabolic trough, power tower, dish engine systems, and photovoltaics.

- Migratory Bird Treaty Act of 1918, as amended;
- Bald and Golden Eagle Protection Act;
- Fish and Wildlife Conservation Act of 1980;
- Taylor Grazing Act of 1934; and
- National Historic Preservation Act of 1966, as amended.

1.8 OTHER PLANS AND PROGRAMS APPLICABLE TO THE RDEP

In addition to BLM programs, state- and national-level initiatives have been developed to promote renewable energy development. Implementation of the RDEP would help meet the goals outlined in the listed initiatives by simplifying and standardizing the process for renewable energy development on BLM-administered lands and by providing analysis that would aid wind and solar energy development on other lands in the state.

1.8.1 Executive Order 13514, Federal Sustainability Policy

On October 5, 2009, President Obama issued Executive Order 13514, which tasked federal agencies with integrating achievement of sustainability goals with agency mission and strategic planning to optimize performance and reduce implementation costs. In addition to specific sustainability goals for federal agencies, the executive order calls on the Interagency Climate Change Adaptation Task Force to develop, within one year, federal recommendations for adapting to climate change impacts both domestically and internationally.

1.8.2 Executive Order 13212, Actions to Expedite Energy-Related Projects

On May 18, 2001, President Bush signed Executive Order 13212, which states, "the increased production and transmission of energy in a safe and environmentally sound manner is essential." Executive departments and agencies are directed to "take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy." Executive Order 13212 further states, "For energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects, while maintaining safety, public health, and environmental protections. The agencies shall take such actions to the extent permitted by law and regulation and where appropriate."

1.8.3 Western Governors' Association and U.S. Department of Energy Renewable Energy Zones Initiative

A document entitled "Western Renewable Energy Zones – Phase 1 Report" was published by the Western Governors' Association and the U.S. DOE in June 2009 (Western Governors' Association and DOE 2009). This Phase 1 Report was produced in an effort to facilitate the construction of new utility-scale renewable energy facilities and any needed transmission with the

goal of delivering this energy into the Western Interconnection. (The Western Interconnection refers to the existing electricity grid linking Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming; El Paso area, Texas; and Alberta and British Columbia, Canada.) The Phase I identified Western Renewable Energy Zones (WREZs). These zones have the potential for large-scale development of renewable resources in areas with low environmental impacts and are subject to resource-specific permitting processes. Stakeholders such as renewable energy developers, tribal interests, utility planners, environmental groups, and government policy-makers contributed to planning and mapping new WREZs. The report also evaluated various transmission strategies, which involved facilitating the development of high-voltage transmission to those areas with the potential for abundant renewable resources and low or easily mitigated environmental impacts. The report implemented a modeling tool to evaluate the relative economic costs of renewable resources on a delivered basis.

1.8.4 Arizona's Renewable Portfolio Standard Program

RPSs are state laws requiring electric utility providers to obtain a minimum percentage of their energy from renewable generation sources. These renewable sources include geothermal, wind, solar, hydroelectric, and other renewables such as biomass. Arizona has set a goal of 15 percent electricity generated from renewable sources by 2025.

1.8.5 Arizona's Renewable Resource and Transmission Identification Subcommittee

The Arizona Renewable Resource and Transmission Identification Subcommittee (ARRTIS) was created in 2009 and included participants from electrical utilities, renewable energy developers, federal and state land and resource management agencies, environmental advocacy groups, consultants, and numerous other stakeholders. The ARRTIS gathered data on environmental sensitivity and identified areas where solar and wind resources were technically ideal for utility-scale development. A four-tier environmental sensitivity and constraint classification system was established to characterize land areas into categories. The ARRTIS developed criteria for exclusion areas and found that approximately half of Arizona's land area was located outside of the identified exclusion areas for utility-scale generation, barring all permitting and analytical processes (ARRTIS 2009).

1.8.6 Arizona's Solar Electric Roadmap Study

The Arizona Department of Commerce (which is now the Arizona Commerce Authority) and the Commerce and Economic Development Commission (CEDC) commissioned this project to help inform a 10-year Arizona economic strategy for future business development in the solar industry. Solar energy, along with water resources and sustainable manufacturing, was identified in the 2004 Sustainable Systems Prospectus as

an economy-defining industry opportunity for Arizona based on the research and development strengths of Arizona's university system and building on its presence as one of three solar labs in the world.

1.8.7 Arizona Game and Fish Department – Planning for Wildlife

The goal of responsible planning for wildlife at the landscape or community scale is to balance the growth, diversity, and mobility of Arizona's human population with the sustainability, diversity, and mobility of Arizona's wildlife populations. The Arizona Game and Fish Department (AZGFD) has assembled wildlife conservation data, maps, tools, and other information to help inform and guide development in a manner that maintains the quality of Arizona's landscapes and minimizes negative impacts on wildlife and wildlife habitat. The department has issued a number of planning guidance documents for renewable energy development, including Guidelines for Reducing Impacts to Wildlife from Wind Energy Development in Arizona (AZGFD 2009) and Guidelines for Solar Development in Arizona (AZGFD 2010). Additionally, the department as developed the HabiMap™ to visually explore the distribution of wildlife in Arizona, potential stressors to wildlife, and other relevant data at a statewide scale. The department provided wildlife datasets used for analysis in this EIS.

1.8.8 Arizona State Land Department - Arizona Renewable Energy Mapping Project

The Arizona State Land Department plays an important role in the development of renewable energy. Specifically, the ASLD works with renewable energy developers to identify potential sites and process solar leases and wind right-of-way applications for renewable energy generation on State Trust Lands. The ASLD has partnered with the BLM and private landowners in siting renewable projects; for example, the ASLD recently partnered with the BLM on the Dry Lake Wind Power Project, situated on federal, state, and private lands in Navajo County. The department maintains an active GIS database and mapping program to facilitate permitting and site assessments and is helping to develop the Arizona Renewable Energy Mapping Project.

The Arizona Renewable Energy Mapping Project is a collaborative project to create a renewable energy mapping system to facilitate the development of Arizona's renewable energy resources in a coordinated manner. The system provides information to the public, the renewable energy industry, and public agencies on lands in Arizona to help users evaluate lands for their general potential for development as renewable energy generation sites.

1.9 PUBLIC INVOLVEMENT

Public involvement, which includes public scoping, is required under NEPA, as defined in CEQ regulations 40 CFR 1500–1508, DOI NEPA regulations 43 CFR 46, and the BLM NEPA Handbook (BLM Handbook H-1790-1), and under FLPMA, as defined in 43 CFR 1610.2 and 1610.4-1 and the BLM Land Use Planning Handbook (BLM Handbook H-1601-1), which provide additional guidance and direction for public involvement.

The RDEP engaged multiple cooperating agencies, stakeholders, and the general public for a broad understanding on the desired future renewable energy footprint on federal, tribal, state, and private lands in Arizona. Cooperating agencies are state or federal agencies, or local or tribal governments that enter into formal relationship with the BLM to help develop EISs. Each cooperating agency's level of involvement is at their own discretion and can include participating in issue identification, collecting inventory data, contributing to alternative formulation, and estimating effects of alternatives (BLM Land Use Planning Handbook, H-1601-1, pg. 8). The cooperating agencies on the RDEP include the following:

- Bureau of Reclamation;
- Western Area Power Administration;
- Arizona Game and Fish Department;
- Arizona State Land Department;
- Arizona Department of Environmental Quality;
- Arizona Corporation Commission;
- Central Arizona Water Conservation District; and
- Arizona Department of Water Resources.

The BLM initiated consultation with the Arizona State Historic Preservation Officer in April 2010 in accordance with the Protocol for Managing Cultural Resources on Lands Administered by the Bureau of Land Management in Arizona. Consultations will continue through the course of the EIS process to ensure compliance with the National Historic Preservation Act (NHPA) and NEPA. The BLM has also contacted and consulted with several Native American tribal governments (all the tribes contacted are listed in **Chapter 6**, Consultation and Coordination). Formal letters were sent to all tribes in Arizona, and presentations have been made at tribal council meetings. BLM continues to remain in contact via in-person meetings, phone calls, and emails, and by responding to individual requests for additional information or meeting presentations.

The RDEP outreach started with scoping and publication of the Notice of Intent on January 13, 2010 (Federal Register, Vol. 75, No. 8, pg. 1807; both

the Notice of Intent and Scoping Report are available on-line at the RDEP Web site: http://www.blm.gov/az/st/en/prog/energy/arra_solar.html). The BLM sought identification of site locations of previously disturbed or utilized lands in addition to identification of issues that might be associated with the RDEP. Local, state, and federal agencies, private companies, and members of the public nominated 42 potential sites. The BLM continued to receive nominations through the Web site, individual letters, and scoping meetings, during which local governments, businesses, and members of the public identified additional potential locations for consideration; to date, an additional 22 sites have been added for consideration (see the nominated sites identified in **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites). The BLM identified additional key issues to be addressed in the EIS (see **Section 1.10**, Key Planning Issues for a summary of these issues).

The BLM has provided information on the RDEP project and has sought additional information and data to support alternatives development and analysis from groups that have invited BLM to share information and address public forums regarding the RDEP. The BLM met with these stakeholder groups to identify any additional opportunities for or constraints on the project. The groups included Arizona state agencies, military installations, Arizona utilities, and environmental organizations. A full listing of the groups and agencies consulted are listed in **Chapter 6**, Consultation and Coordination.

The BLM has distributed the Draft EIS to individuals, agencies, and organizations on the RDEP mailing list and to all cooperating agencies for a 90-day public comment period. Following the public comment period, the BLM will review the comments and will revise the EIS if warranted.

As the project moves forward, there will be additional opportunities for public involvement and comment. Public involvement opportunities will be advertised through local news media, the Federal Register, email, the RDEP Web site, and newsletters posted to mailing list recipients. Also, key project documents will be published on the Web site and made available in individual BLM Arizona Field Offices. Future key public involvement opportunities include the following:

- Publication of a Proposed RMP Amendments and Final EIS. In compliance with BLM planning regulations (43 CFR 1610), a 30-day public protest period will begin following publication. The Governor of Arizona will have 60 days to review the document for consistency with state and local plans and policies. Approval shall be withheld on any portion of the amendment being protested until final action has been completed on such protest. Before such approval is given, there shall be public notice and

opportunity for public comment on any significant change made to a proposed plan decision.

- The BLM will accept public input throughout the process. All of the materials and documents related to the project will be made available on the RDEP web site. Dates for the official public comment and protest periods, along with other relevant project dates, also will appear on the Web site.

1.10 KEY PLANNING ISSUES

The following list encapsulates the specific issues and questions raised by the public and the BLM during the scoping process:

1. Stakeholders and Collaboration: How will the BLM work with stakeholders across the state to leverage local knowledge, secure data sources, and consider local needs?
2. Site Criteria: What criteria will be applied to the nominated sites to determine suitability for inclusion in the alternatives – for example, proximity to population and energy development potential?
3. Transmission Lines: How will the BLM consider the need for new transmission lines or proximity to existing transmission lines in site selection and alternatives development?
4. Balancing Development: How will the BLM balance the development of renewable energy sites across the landscape?
5. Technology and Infrastructure: How can the BLM accommodate a diversity of technologies, existing infrastructure, and different scales of development?
6. Land Tenure Adjustments: Can BLM exchange or sell disposal parcels in order to benefit local economies and create development incentives?
7. Streamlining Future Analysis: How can this EIS streamline the process for permitting and performing site-specific environmental analyses for sites identified in the future?
8. Remediation: How will the BLM address the need for site-specific remediation?
9. Effects on Resources and Resource Uses: How will the BLM reduce the impacts of renewable energy development on resources and resource uses, including air, water, wildlife, wildlife habitat, wilderness, soils, cultural and paleontological resources, visual resources, and recreation?
10. Socioeconomics and Environmental Justice: How can the BLM implement the project in a way that strengthens state and local

socioeconomic conditions, provides local access to energy, ensures environmental justice, and protects human health and safety?

11. Cumulative Impacts: How will the BLM address the cumulative impacts of renewable energy development and its associated infrastructure on a landscape scale?

1.11 PLANNING CRITERIA

In accordance with BLM planning regulations (43 CFR 1610.4-2), planning criteria were developed to help guide data collection, alternative formulation, and impact analysis. Criteria, such as those that follow, are generally based on laws, regulations, and agency guidance and serve to keep the planning process focused.

- The EIS and land use plan amendments will be completed in compliance with FLPMA, the Endangered Species Act, the Clean Water Act, the Clean Air Act, NEPA, and all applicable laws, Executive Orders, and management policies of the BLM.
- The RFDS for renewable energy development within Arizona provides background on other similar assessments done in Arizona, an overview of wind and solar technologies assumed to be used, the methodology used for preparing the RFDS, the results of the analysis, and conclusions. The RFDS will be used as baseline and to provide context for the analysis.
- Unless specifically amended by the ROD for this EIS, the BLM will continue to manage resources and uses by existing land use planning decisions.
- The RMPs, as amended, will recognize valid existing rights.
- The BLM will coordinate with local, state, tribal, and federal agencies during the EIS process to strive for consistency with existing plans and policies, to the extent practicable.
- The BLM will coordinate with tribal governments and will provide strategies for the protection of recognized traditional uses in the EIS process.
- The BLM will take into account appropriate protection and management of special status plant and animal species in the EIS and will engage in all required consultation.
- The BLM will take into account appropriate protection and management of cultural and historic resources in the EIS and will engage in all required consultation.

- The BLM will recognize in the EIS the specific niche occupied by public lands in the life of the communities that surround them or that are surrounded by them and in the nation as a whole.
- The BLM will encourage public participation throughout the process.
- Environmental protection and energy production are both desirable and necessary objectives of sound land management practices and are not to be considered mutually exclusive priorities.
- The BLM will support planning to provide renewable energy opportunities to help meet public consumptive uses that contribute to climate change.
- Geospatial data will be automated within a GIS to facilitate discussions of the affected environment, formulation of alternatives, analysis of environmental consequences, and display of results.

1.12 SOLAR AND WIND TECHNOLOGIES

Arizona has a wealth of renewable energy resources, especially for those technologies that rely on solar radiation and wind (Black & Veatch 2007). Wind power utilizes turbines to convert wind to electricity. A wind turbine consists of a blade or rotor, a drive train (usually including a gearbox and a generator), a tower, and other equipment, including controls, electrical cables, ground support equipment, and interconnection equipment. The blades turn in the moving air and power an electric generator that supplies an electric current.

Solar radiation may be harnessed through various technologies and transformed to usable energy, such as heat and electricity. Two basic solar energy technologies that produce electrical power for commercial applications are (1) concentrating solar power (CSP) systems, which use mirrors to concentrate sunlight onto receivers that convert it to heat used to drive a generator via a steam turbine or heat engine to produce electricity, and (2) photovoltaic (PV) systems, which use solar cells made of semiconductor materials to capture the energy in sunlight and convert it directly into electricity. Additional details for these and other technologies are provided in the RFDS document produced for this project (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona).

1.13 READER'S GUIDE TO THE EIS

The EIS is divided into two volumes. Volume I provides the EIS, and Volume II provides supporting appendices.

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Figure ES-2, Comparison of Conceptual Alternatives of REDA on BLM-Administered Lands and **Figure ES-3**, Comparison of Conceptual Alternatives on Non-BLM-Administered Lands provide an overview of the alternatives analyzed in the EIS. These figures are found at the end of the Executive Summary. **Table 2-12**, Summary of the Alternatives, provides a summary of the goals, objectives, allocations, and management actions for each alternative. **Table 2-13**, Summary of Environmental Consequences by Alternative, provides a summary of impacts on resources and resource uses under each alternative. These tables are found at the end of **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario of this EIS.

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CHAPTER 2
DESCRIPTION OF ALTERNATIVES AND THE REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

2.1 INTRODUCTION

The National Environmental Policy Act, under which the EIS is being developed, directs the BLM to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources…" (NEPA Section 102(2)(e)). At the heart of the alternative development process is the required development of a range of reasonable alternatives. Public and internal (within BLM) scoping has identified issues that present opportunities for alternative courses of action, while the purpose and need for action provides sideboards for determining "reasonableness."

The RFDS identifies the lands in Arizona that are most suitable for the development of solar and wind energy resources, and estimates the acreage of those lands required to support renewable energy projects that would not only meet but exceed the Arizona RPS of 15 percent renewable energy by 2025.

This chapter provides the details of the No Action Alternative, which would continue the BLM's existing policies; six action alternatives, including the BLM's preferred alternative; and a discussion of alternatives considered but eliminated from detailed analysis.

The end of the chapter includes a summary of the RFDS scenario for renewable energy in Arizona (**Section 2.6**, Summary of the Reasonably Foreseeable Development Scenario). The solar and wind technologies described here are representative of those most likely to be deployed over the next 20 years; however, the described procedures and processes could apply to other land area-based renewable energy technologies (e.g., algae ponds), with additional mitigation requirements developed on a project-by-project basis.

2.2 ALTERNATIVE DEVELOPMENT PROCESS

The BLM proposes to identify REDAs and establish management actions, design features, and land tenure and reuse policies applicable to solar and wind energy development on BLM-administered lands in Arizona. The REDAs would identify where solar and wind energy development is likely to be compatible with resource objectives, and the management actions and design features would bring consistency and efficiency to the BLM's authorization process. In addition, the BLM is proposing to identify a SEZ for utility-scale solar development. This section describes the methods used to develop alternatives to achieve these proposals.

CEQ regulations require including the No Action Alternative (40 CFR 1502.14[d]) even if it does not meet the purpose and need for the proposed action. The No Action Alternative provides a useful baseline for comparison of environmental effects (including cumulative effects) and demonstrates the consequences of not meeting the need for the action. For the RDEP, the No Action Alternative was developed by reviewing and analyzing all of the Arizona RMPs for renewable energy decisions, land disposal parcels and criteria, the granting of authorization for use, occupancy, and development, and the terms and conditions that may apply to development areas.

In addition to the No Action Alternative, six action alternatives were developed. These alternatives are the result of extensive consultation and coordination with the public, tribes, cooperating agencies, and stakeholders (see **Chapter 6**, Consultation and Coordination). All of the action alternatives were developed to meet the purpose and need for the proposed action (**Section 1.2**, Purpose and Need for the RDEP) and to address the planning issues (**Section 1.10**, Key Planning Issues). Additionally, the alternatives incorporate policies, design features, guidance, and direction from the national BLM renewable energy efforts (see **Section 1.4**, The RDEP's Relationship to National and Statewide BLM Policies and Programs), including the Wind PEIS (BLM 2005) and the proposed Solar Energy Program presented in the Draft Solar PEIS, as supplemented.

Identification of lands suitable for solar and wind renewable energy development was a collaborative process, involving not only the BLM but cooperating agencies, stakeholders, and the public.

Identifying lands as REDAs was an iterative process that provided a range of alternatives. Public scoping and collaboration with cooperating agencies and stakeholders revealed that renewable energy development would be best suited on lands that are disturbed and/or have low resource sensitivity. Lands with low resource sensitivity are areas that are unlikely to contain resources protected by statute or policy, that currently do not have special designations or uses, that are unlikely to contain other recognized values, or for which impacts from development cannot be mitigated (for example, groundwater is a sensitive resource in many parts of Arizona; however, the BLM has the authority to require non-consumptive technologies to mitigate the impact). The BLM collected relevant information from BLM datasets, cooperating agencies, stakeholders, universities, and other public sources.

The complete listing of these resource datasets is in **Table 2-1**, Areas with Known Sensitive Resources (Eliminated from REDA Consideration). The data were loaded into a GIS and analyzed to geographically identify low-sensitivity lands that could be suitable for renewable energy development. These lands represent Alternative 1, Maximum REDA.

After defining the Maximum REDA, the BLM looked to the main planning issues to form the themes of the other action alternatives: transmission issues, water issues, disposal/land tenure issues, previously disturbed lands, and load centers. Four of the issue categories – transmission, water, land tenure, and load centers – formed the core of four action alternatives, with the idea for reusing previously disturbed lands being included as an option for all alternatives. Based on these themes, the BLM developed Alternatives 2 through 5 by overlaying issue-specific GIS layers (e.g., existing and proposed transmission corridors) on the Maximum REDA alternative. Alternative 6, the Collaborative-Based Alternative, combines the analysis from the other alternatives to address the planning issues.

While decisions made from this EIS will only apply to BLM-administered public lands, the analysis was conducted statewide regardless of land status to facilitate statewide planning and identify areas for possible partnering between the BLM and other federal or state agencies and private land owners. Unless specifically nominated, the analysis does not include tribal or Department of Defense lands.

In addition to identifying REDAs, the RDEP is serving as a step-down process to the Solar PEIS. As such, the BLM is also proposing to identify the Agua Caliente SEZ to facilitate the development of utility-scale solar projects (see **Figure 2-1**, Proposed Agua Caliente SEZ). The proposed SEZ was developed based on a screening process that included the following criteria: available large contiguous parcels of BLM land (greater than 2,500 acres); proximity to transmission; limited known environmental or cultural constraints; proximity to roads and infrastructure; and adjacent to existing solar developments. All of the lands within and adjacent to the Maximum REDA were reviewed. The Agua Caliente area proved to best meet the criteria. After identification of the proposed SEZ, the BLM solicited the local BLM office (the Yuma Field Office), regional Arizona Game and Fish office, and stakeholder groups for resource information specific to that location. These groups provided information indicating that portions of the SEZ had excellent recreational hunting access and use, cultural resources, and proposed wildlife reintroduction locations. As a result of this input, two smaller SEZ footprints were proposed for consideration. Five of the action alternatives contain either the small, medium, or large proposed SEZ footprint as an element of the alternative; one action alternative does not propose a SEZ.

A **Solar Energy Zone** (SEZ) is an area of land identified by the BLM, in collaboration with other federal, state, and local agencies or stakeholders, as best suited for large-scale solar energy production (20 MW or greater).

In Arizona, the BLM is proposing two SEZs in the Solar PEIS and one SEZ in this EIS.

Table 2-1
Areas with Known Sensitive Resources (Eliminated from REDA Consideration)

Areas with Known Sensitive Resources	Source
BLM Areas of Critical Environmental Concern (ACECs)	BLM 2011b
BLM Backcountry Byways	BLM 2011b
BLM Designated Wilderness and Wilderness Study Areas	BLM 2011b
BLM Lands with wilderness characteristics managed to protect those characteristics	BLM 2011b
BLM Lands with wilderness characteristics not managed to protect those characteristics	BLM 2011b
BLM Visual Resource Management Classes I, II, and III	BLM 2011b
BLM Special Recreation Management Areas	BLM 2011b
BLM ROW exclusion or avoidance areas	BLM 2011b
BLM Herd Management Areas	BLM 2011b
Gila River Terraces (proposed cultural resources ACEC)	BLM 2011b
Designated BLM Utility Corridors	BLM 2011b
National Monuments	BLM 2011b
National Conservation Areas	BLM 2011b
Wild and Scenic Rivers (either eligible or suitable for inclusion in the National Wild and Scenic Rivers System or rivers included in the National Wild and Scenic Rivers System)	BLM 2011b
National Park System units, including Petrified Forest National Park Expansion Area	BLM 2011b, SWReGAP 2011
National Park System National Historic Trails (0.25-mile buffer)	BLM 2011b
Indian Lands	BLM 2011b
Military Lands	BLM 2011b
State Parks	Arizona State Parks 2010
State Wildlife Areas	BLM 2011b
U.S. Fish and Wildlife Service (USFWS) lands	BLM 2011b
The Nature Conservancy conservation easements, Audubon Society land, and private conservation easements	SWReGAP 2011
U.S. Forest Service Designated Wilderness	Forest Service 2010a
U.S. Forest Service Established Research Natural Areas	Forest Service 2010b
U.S. Forest Service Inventoried Roadless Areas	Forest Service 2010c
U.S. Forest Service Heber Wild Horse and Burro area	Forest Service undated
U.S. Forest Service Special Interest Management Areas	Forest Service 2010b
Airports (0.25-mile buffer)	National Atlas 2010
Incorporated cities (except when BLM land is included within boundary of an incorporated city)	ALRIS 2011a

Table 2-1 *(continued)*
Areas with Known Sensitive Resources (Eliminated from REDA Consideration)

Areas with Known Sensitive Resources	Source
Arizona Game and Fish Department Areas of Conservation Potential, Tiers 4, 5, and 6	AZGFD 2011a
Arizona Game and Fish Department big game habitat, including bighorn sheep, black bear, elk, javelina, mountain lion, mule deer, turkey, white-tailed deer	AZGFD 1988
Special status species, including threatened, endangered, and BLM sensitive species locations	AZGFD 1988
Arizona Game and Fish Department wildlife corridors	AZGFD (undated)
USFWS critical habitat for threatened and endangered species	USFWS 2010
BLM sensitive species habitat	BLM 2011b
Desert tortoise (*Gopherus agassizii*) Sonoran population habitat categories I, II, and III	BLM 2011b
National Wetland Inventory wetlands	NWI 2010
Waterbodies (lakes, rivers, and dry lakes)	BLM 2011b
Federal Emergency Management Agency 100-year floodplains	FEMA 2010
Areas of high potential for known mineral deposits, metallic mineral districts, Holbrook Basin potash potential	AZGS 2008, Arizona Bureau of Geology and Mineral Technology 1983, Arizona Bureau of Mines 1993
Sensitive fossil resources	BLM 2011b
Severe soils: Clay Springs (runoff medium to rapid and erosion hazard moderate to severe) and Rositas (wind erosion severe if natural surface and cover disturbed)	BLM 2011b, Description of Soil Series 2010
Greater than 5-percent slopes (or greater than 15-percent slopes for areas with wind potential)	USGS 2010, BLM 2011b

Proposed Agua Caliente SEZ

The proposed Agua Caliente Solar Energy Zone (SEZ) Alternatives 1 and 4 were based upon large continuous tracts of BLM-administered land that had limited known environmental constraints, near transmission lines, access roads, and an existing solar development. The proposed Agua Caliente SEZ Alternatives 2 and 6 were based upon avoiding braided channel floodplains, camping areas, mule deer habitat, and wilderness characteristics. The proposed Agua Caliente SEZ Alternative 3 was based upon consolidating development into a small footprint.

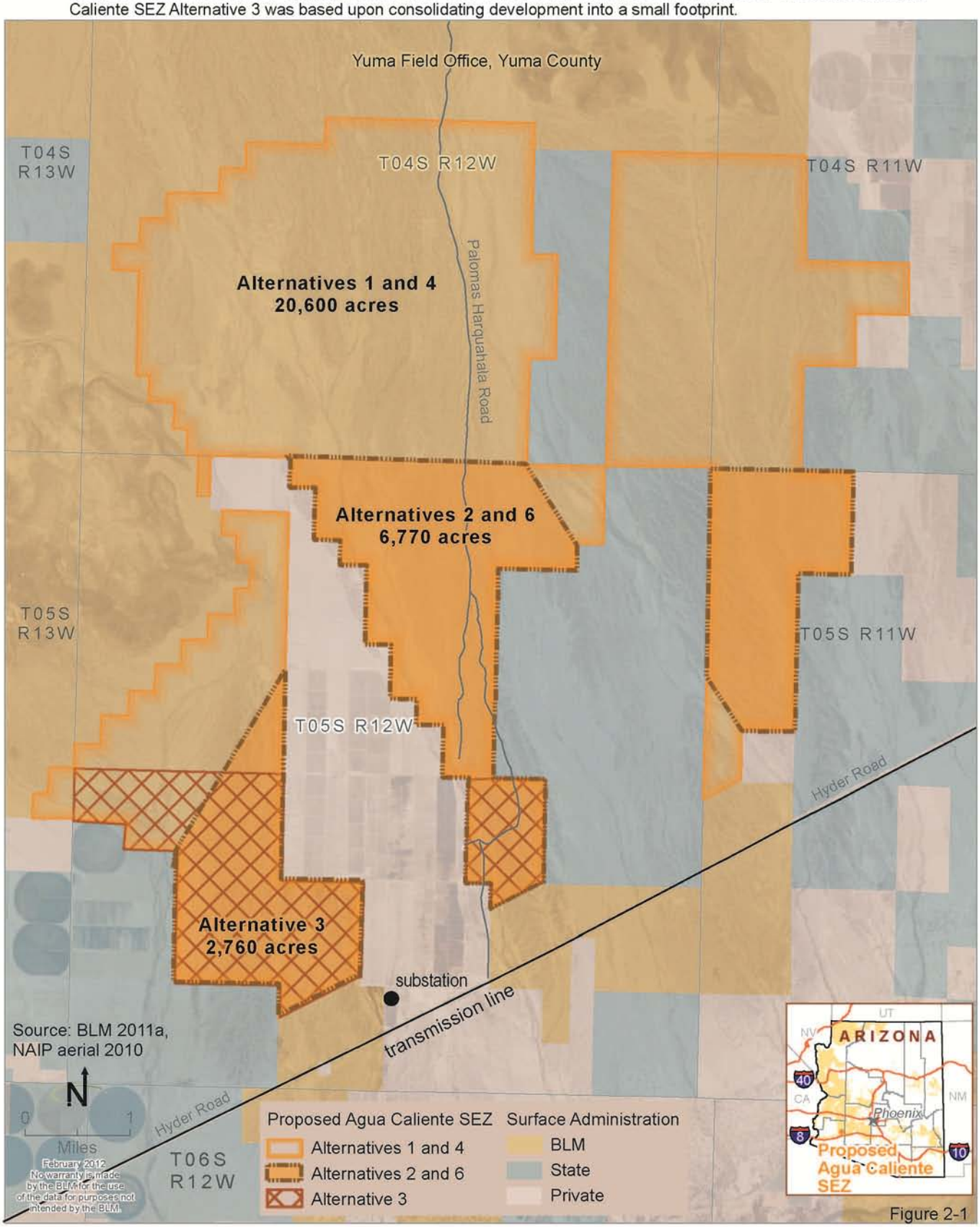


Figure 2-1

2.3 ALTERNATIVES

Decisions in land use plans guide future land management actions and subsequent site-specific implementation decisions. These land use plan decisions establish goals for resource management and the measures needed to achieve these goals (management actions and allowable uses). The alternatives below describe the existing land use plan decisions (No Action Alternative) and proposed changes to land use plans in the action alternatives.

2.3.1 No Action Alternative

Under the No Action Alternative, renewable energy projects would be developed through ROW authorizations and land disposal actions in accordance with the BLM's existing lands and realty policies, existing solar or wind development policies, and existing RMP decisions (see **Figure 2-2**, No Action Alternative). Additionally, the BLM would not identify the Agua Caliente SEZ.[4]

Under this alternative, the BLM would continue to consider applications for development on all BLM-administered lands unless such development is prohibited by law, regulation, or RMP decision. Each BLM RMP has identified areas as ROW avoidance areas, exclusion areas, or available for application. Avoidance areas are those lands that are to be avoided but may be available for location of ROWs with special stipulations; exclusion area would not be available for a ROW application under any circumstances. Available areas would be available for application under the terms and conditions outlined in the respective RMP. BLM-administered lands excluded from renewable energy development include the following:

- National Monuments;
- National Conservation Areas; and
- Wilderness Areas.

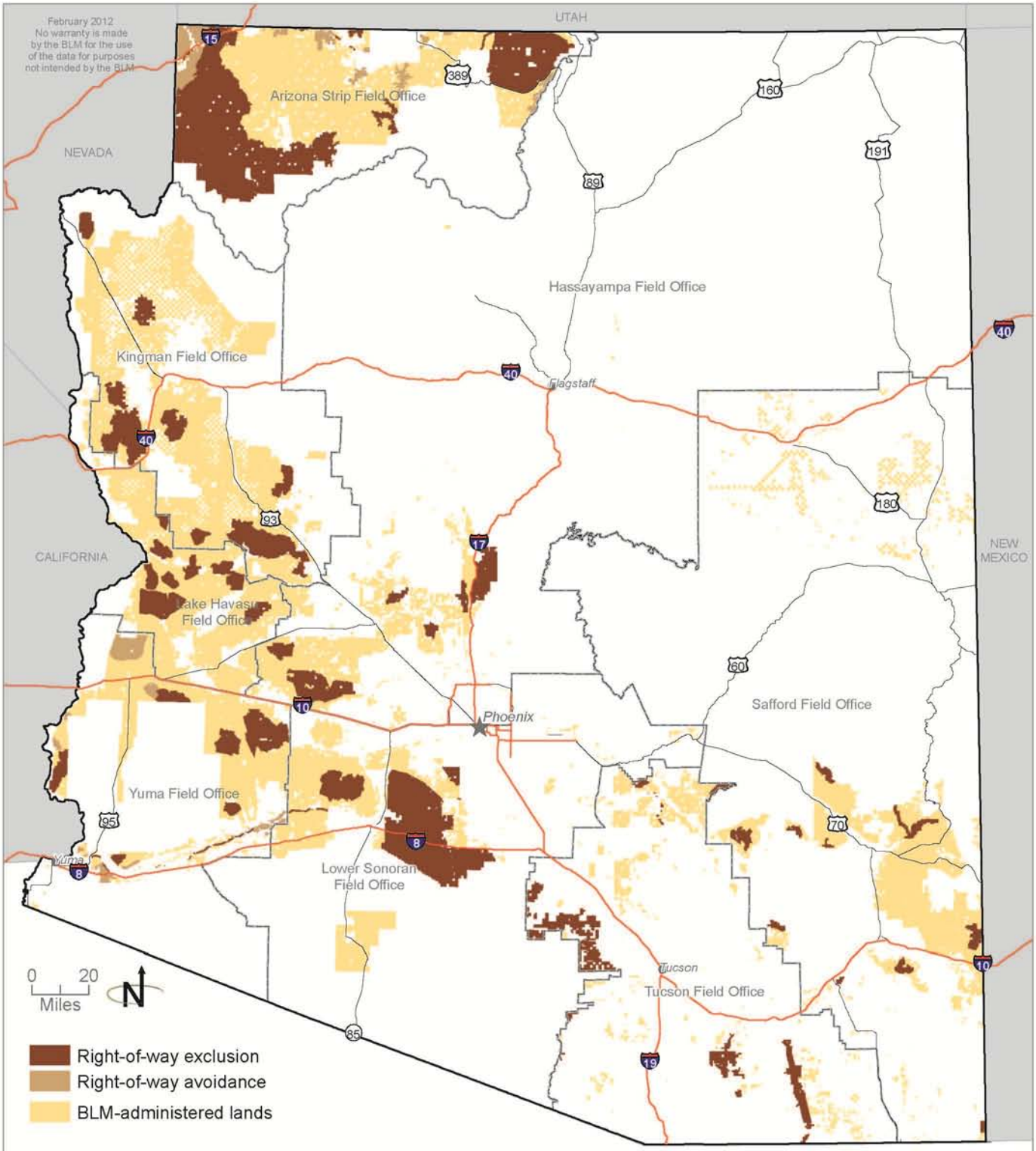
Areas administratively excluded from renewable energy development vary by field office and individual RMP decisions, and may include ACECs, National Historic Trail corridors, lands supporting habitat for listed species, and riparian areas. Under the No Action Alternative, none of the Arizona RMPs would be amended and the Yuma RMP decisions would not change.

There are approximately 12.2 million surface acres of BLM-administered land in Arizona. Of the 12.2 million acres of BLM land, approximately 3.2

[4] Should the Solar PEIS result in a ROD, those decisions would likely result in changes to how utility-scale solar development is authorized on BLM-administered lands in Arizona.

No Action Alternative

Renewable energy projects would be developed through right-of-way authorizations in accordance with existing policies and Resource Management Plan decisions. BLM National Monuments, National Conservation Areas, and Wilderness Areas are legislatively excluded. Wilderness Study Areas and Lands with Wilderness Characteristics are administratively excluded.



Source: BLM 2011b

Figure 2-2

million acres are administratively closed to ROW applications, and 8.7 million acres are potentially available for ROW applications (BLM and DOE 2010).

Table 2-2, No Action Alternative: Acres Available and Excluded for ROW Applications, illustrates the amount of available and excluded acreage in existing decisions.

Table 2-2
No Action Alternative: Acres Available and Excluded for ROW Applications

	BLM-Administered Land (acres)
ROW exclusion areas	3,220,200
ROW avoidance areas	271,000
Available for ROW Application[5]	8,708,800

NEPA analyses for renewable energy development on BLM-administered lands would be prepared on a project-by-project basis. ROW exclusion areas and mitigation measures would be implemented in accordance with existing land use plans. In addition, projects that require land use plan amendments would be processed on an individual basis as needed.

2.3.2 Elements Common to All Action Alternatives

Land use plan decisions for public lands fall into two categories: desired outcomes (commonly described as goals), and allowable (including restricted or prohibited) uses and actions anticipated to achieve desired outcomes. Goals are broad statements of desired outcomes that usually are not quantifiable. Once the goals are established, the BLM identifies allowable uses (land use allocations) and management actions that are anticipated to achieve the goals.

Land use plans must identify uses (allocations) that are allowable, restricted, or prohibited on BLM-administered land. For RDEP, this entails identifying the REDAs. Land use plans must also identify the actions anticipated to achieve the goals, including actions to maintain, restore, or improve land health. These could include proactive measures as well as measures or criteria that would be applied to guide day-to-day activities occurring on BLM-administered land.

[5] The acreage for available lands was determined by subtracting exclusion and avoidance areas from the estimated total of BLM-administered lands in Arizona. However, it should be noted that avoidance areas may be available for ROWs and would be subject to special stipulations.

The goals, management actions, design features, best management practices, and allocations common to all of the alternatives are described below.

Lands Available for Renewable Energy Development

Lands identified as REDAs would be available for renewable energy application. REDA lands would be subject to existing BLM renewable energy programs' policies and procedures. Because identified REDA lands may meet the requirements of the variance process outlined in the Supplement to the Draft Solar PEIS, incentives such as priority processing would likely apply. REDA lands would be available for multiple uses, including off-highway vehicle (OHV) use, grazing, and recreation as allowed by the appropriate RMP decisions for the area. However, once a renewable energy application is submitted or a development proposed, the primary use of the area would be for renewable energy development.

For lands that have been identified for disposal in a BLM RMP, the BLM may decide to dispose of some of these parcels through land sales or exchanges to support the development of solar energy on a case-by-case basis. The BLM's existing ROW regulations, contained in 43 CFR Part 2800, existing land sale regulations, contained in 43 CFR Parts 2710 and 2711, and existing exchange regulations, contained in 43 CFR Part 2200, provide for these possible procedural approaches. Should the BLM decide to make lands available for disposal, additional land use plan amendments would be required and additional NEPA analysis may be necessary. Depending on the timing of such decisions, these program elements may be included in the ROD for the Solar PEIS or may be issued in separate decision documents.

Identified SEZ lands would be subject to existing solar energy policies and any decisions that result from the Solar PEIS.

Renewable Energy

Goals:

- Ensure the most environmentally responsible development and delivery of renewable energy; and
- Help meet community energy needs, create economic opportunities, and provide good value to the taxpayer.

Objectives:

- Identify disturbed sites, such as brownfields, landfills, abandoned mines, etc., which could be reused for renewable energy development;
- Identify areas with low resource sensitivity to lessen the risk of environmental conflicts;
- Identify areas suitable for development that are adjacent to load centers;

- Identify areas close enough to existing transmission to make it efficient and cost effective to bring the energy on-line;
- Identify areas with enough acreage of public lands to help meet the renewable energy demand (including the Arizona RPS), and provide flexibility for micro-siting and mitigation;
- Identify a SEZ specifically for utility-scale solar energy developments (more than 20 MW) in accordance with national BLM policy and guidance (BLM and DOE 2010, 2011; Solar PEIS); and
- Engage cooperating agencies, tribes and stakeholders in order to obtain broad consensus on the desired future renewable energy footprint in Arizona and to inform renewable energy developers in their siting of projects throughout the state.

Management Actions

Management actions are identified actions that are anticipated to achieve the RDEP's goals and desired outcomes; they include actions to maintain, restore, or improve land health, as well as measures or criteria that will be applied to guide day-to-day activities (e.g., applications) occurring on public lands. Management actions for renewable energy activities are as follows:

- Follow all applicable laws, regulations, policies, and guidance, including but not limited to the National Environmental Policy Act, Endangered Species Act, National Historic Preservation Act, and Federal Land Policy and Management Act;
- Conduct consultation with cooperating agencies and stakeholders, including but not limited to military installations, the National Park Service, the Federal Aviation Administration and other federal agencies, federal and state resource management agencies (e.g., Arizona Game and Fish Department, Department of Water Resources, etc.), lease and mining claim holders and grazing permittees, and state, local, and tribal governments;
- Renewable energy development will have first priority over other land uses within REDAs while honoring valid existing rights;
- Renewable energy development applications within the REDAs will have first priority processing over applications located outside of the REDAs; electricity transmission projects related to applications in REDAs will also receive priority processing;

Management actions are identified actions that are anticipated to achieve the RDEP's goals and desired outcomes; they include actions to maintain, restore, or improve land health, as well as measures or criteria that will be applied to guide day-to-day activities occurring on public lands.

- Require appropriate design features on all renewable energy development projects as described in **Appendix B**, Design Features and Best Management Practices;
- Renewable energy development projects will not be permitted within a designated utility corridor;
- Avoid creating areas that are inaccessible to the public and/or would be difficult to manage. The effect on the manageability and use of public lands around boundaries of renewable energy facilities will be considered during environmental analysis of project applications; and
- Consolidate access and other supporting infrastructure for single projects and for cases in which more than one project is close to another to maximize efficient use of public land.

Design Features

Design features are means, measures, or practices intended to reduce or avoid adverse environmental impacts. The RDEP has a suite of design features, including those from the Wind PEIS ROD and Solar PEIS that would establish the minimum specifications for management of individual renewable energy projects and mitigate adverse impacts; appropriate design features must be incorporated into project-specific Plans of Development (PODs), Plans of Operations, and ROW grants. In general, the design features are accepted practices that are known to be effective when implemented properly at the project level. However, their applicability and overall effectiveness cannot be fully assessed except at the project-specific level when the project location and design are known. The proposed design features are presented in **Appendix B**, Design Features and Best Management Practices, by resource topic and project phase (i.e., siting and design, site characterization, construction, operations, decommissioning).

Many of the design features indicate the need for project-specific plans and studies. The content and applicability of these plans will depend on specific project requirements and locations; however, the design features provide some guidance of what to include in specific plans. The authorizing officer would need to determine the adequacy of such plans before approving a specific project.

Land Tenure

Goal:

- Pursue the disposal of available BLM-administered land within identified REDAs and the acquisition of non-federal lands within areas of high conservation priority to assist in addressing a water issue or adjusting land patterns to meet public needs.

Objective:

- BLM would consider, on a case-by-case basis, disposing of REDA lands currently identified for disposal in existing RMPs. This could be done using a third-party transaction and/or direct exchange for lands with high conservation value.

Management Actions

- Prior to any available disposal parcel being processed, an additional review would be required to consider the possible presence of priority resources that warrant special protection and/or management that would be best achieved by retention in federal ownership (43 CFR 2430). Prior to disposal, all parcels would be reviewed and would not be disposed if they had any of the following conditions:
 - Designated or proposed critical habitat for threatened or endangered plant or animal species;
 - Supported listed or proposed threatened or endangered species such that the disposal would be inconsistent with recovery needs and objectives or would likely affect the recovery of the listed or proposed species;
 - Supported federal candidate species such that the disposal would contribute to the need to list the species as threatened or endangered;
 - Contain other wildlife resource values of interest, such as BLM sensitive species or big game critical and crucial winter range;
 - Exceptions to the four previous criteria could occur if the recipient of the lands would protect the species or critical habitat equally well under the terms or criteria contained in the Endangered Species Act, such as disposal to a nonfederal governmental agency or private organization if conservation purposes for the species would still be achieved and ensured.
 - Contain Sonoran desert tortoise habitat, unless land disposal through an exchange provides greater benefits to desert tortoises;
 - Contain National Register-eligible cultural resources where mitigation and/or data recovery has not occurred prior to patent;
 - Are managed for wilderness characteristics;
 - Are within the Colorado River 100-year floodplain or riparian areas; or

- Would prohibit wild horse and burro free roaming behavior within or between areas inside the herd management area, or would eliminate habitat within the herd management area such that a significant reduction of the appropriate management levels will result.

Given the screening criteria used to identify REDA lands, these conditions are unlikely to be present in most cases.

Land Reuse

Goal:

- Establish sustainable development practices by reusing disturbed lands for renewable energy development.

Objectives:

- For existing ROWs, BLM would encourage concurrent permitted uses for renewable energy development such as installing solar panels to help energize mine facilities; and
- For new renewable energy actions, BLM Arizona would require submission of proposals for retaining existing infrastructure and for rehabilitating, restoring, reclaiming, and remediating the landscape to meet renewable energy design features as part of Plans of Developments, Plans of Operations, and other permitting documentation.

Management Actions:

- Encourage modifying rehabilitation or remediation plans on in-progress or yet-to-be-rehabilitated lands with renewable energy development interest to meet renewable energy design feature standards;
- Incorporate sustainable development and reuse concepts in the design of new projects; and
- Incorporate ongoing community engagement in all planning, development, implementation, and review actions. This would include working with utilities and the ACC to ensure selected sites fit within existing transmission systems and strategic goals.

Remediation

There are no set rules for remediating disturbed sites such as brownfields, landfills, and mining sites; no two sites are alike, and conditions (e.g., level of contamination, economic incentives, etc.) can vary widely depending on location. However, there are some general goals, strategies, and BMPs that can be used effectively for remediating disturbed sites.

Goals:

- Through creative engineering solutions and environmental policies and programs, encourage remediation of previously disturbed lands to help create economic and social benefits, increase tax revenues, and further community development efforts;
- Work with developers to make previously disturbed sites ready to receive renewable energy projects so growth can be directed to those areas where supporting infrastructure already exists; and
- Target environmental benefits of improved water and air quality and vegetation communities for wildlife through use of remediation protocols on previously disturbed sites.

Management Actions:

- Work with developers to formulate a reuse assessment for the selected site. This involves an objective evaluation of opportunities, challenges, and possible implementation strategies. Additionally, a reuse assessment should consider property condition (physical condition, obsolescence, defects, deferred maintenance, etc.), an analysis of the site as a whole (including any building structures and mechanical and electrical systems), safety issues, and environmental issues (e.g., contamination);
- Evaluate a location's compatibility with any BLM, state, county, or municipality goals, planning, zoning, and economics;
- Evaluate the site's context within surrounding communities, properties, other agency lands, and stakeholders;
- Identify economic assets, economic development opportunities, and economic impacts for the site as part of the reuse assessment; and
- Identify possible partnering opportunities for site remediation.

Best Management Practices:

- Conduct public outreach and education to overcome misperceptions and build support for local projects. Conveying information about risk-based cleanup approaches, cost-effective engineering solutions, liability management options, and available funding programs helps generate interest in disturbed land reuse.
- Integrate remediation and reuse with community priorities. Cleanup and reuse can address multiple community concerns such as the need for locally generated clean energy.

Best management practices (BMPs) are practices or a combination of practices that are determined to provide the most effective, environmentally sound, and economically feasible means of managing an activity and mitigating its impacts.

- Coordinate intra- and inter-governmental relations. Reusing and redeveloping disturbed lands is an interest of many traditionally independent government departments; however, the independent agencies also may share a common interest in reuse and redevelopment to find mutually beneficial solutions.
- Conduct all appropriate inquiry and due diligence as part of the site assessment, including reviews of existing records, interviews with previous owners and operators, identifying existing or past signs of contamination, and following American Society for Testing and Materials standards.
- Plan for and, if necessary, conduct sampling and risk assessments as part of the clean-up process.
- When contamination is determined to be an unacceptable risk to public health and the environment or exceeds a standard, then remediation becomes necessary. Write and implement a remediation plan for the site.
- Completion of the site remediation is determined by either the site being ready and available for reuse or beginning the specific renewable energy project construction.

Site cleanup and reuse can be mutually supportive by leveraging infrastructure needs, sharing data, minimizing demolition and earth-moving activities, reusing structures and demolition material, and combining other activities that support timely and cost-effective cleanup and reuse. Early consideration of green remediation opportunities offers the greatest flexibility and likelihood for related practices to be incorporated throughout a project life. While early planning is optimal, green strategies such as engineering optimization can be incorporated at any time during site investigation, remediation, or reuse.

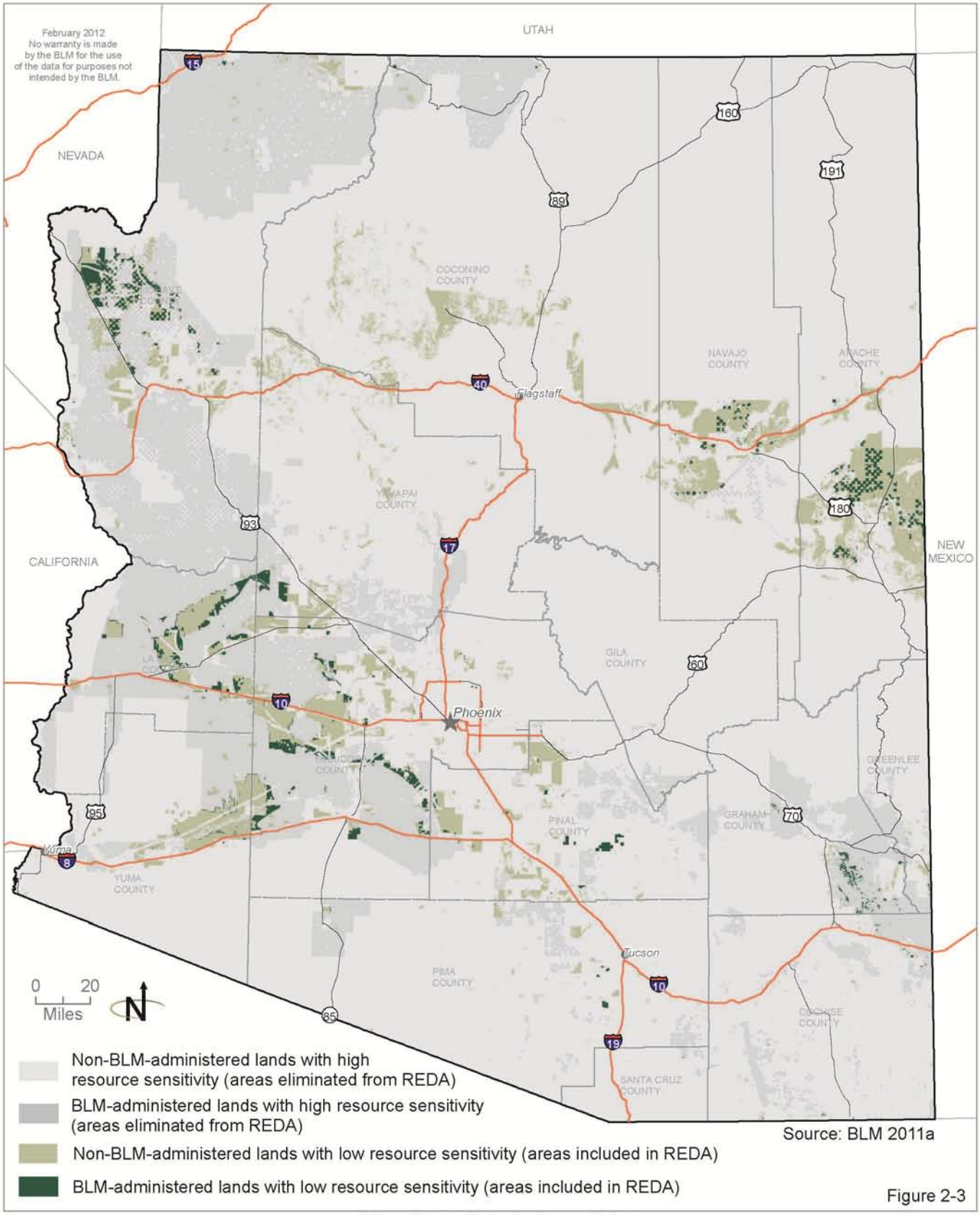
2.3.3 Alternative 1: Maximum REDA

The purpose of this alternative is to maximize opportunities for developing renewable energy while avoiding sensitive resources. It seeks to provide maximum flexibility for locating small- to large-scale projects without consideration of other physical constraints, such as distance to transmission or load. By eliminating known sensitive resources (see **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]), this alternative illustrates the areas that have a higher likelihood of fewer resource obstacles to development.

This alternative includes the nominated previously disturbed lands listed in **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites (**Figure 2-3**, Alternative 1: Maximum REDA - Areas Eliminated from Consideration, and **Figure 2-4**, Alternative 1: Maximum REDA on

Alternative 1: Maximum REDA - Areas Eliminated from Consideration

Areas of known resource sensitivity were eliminated from consideration. Please see Table 2-1 and references for full list of sources for sensitive resource areas.

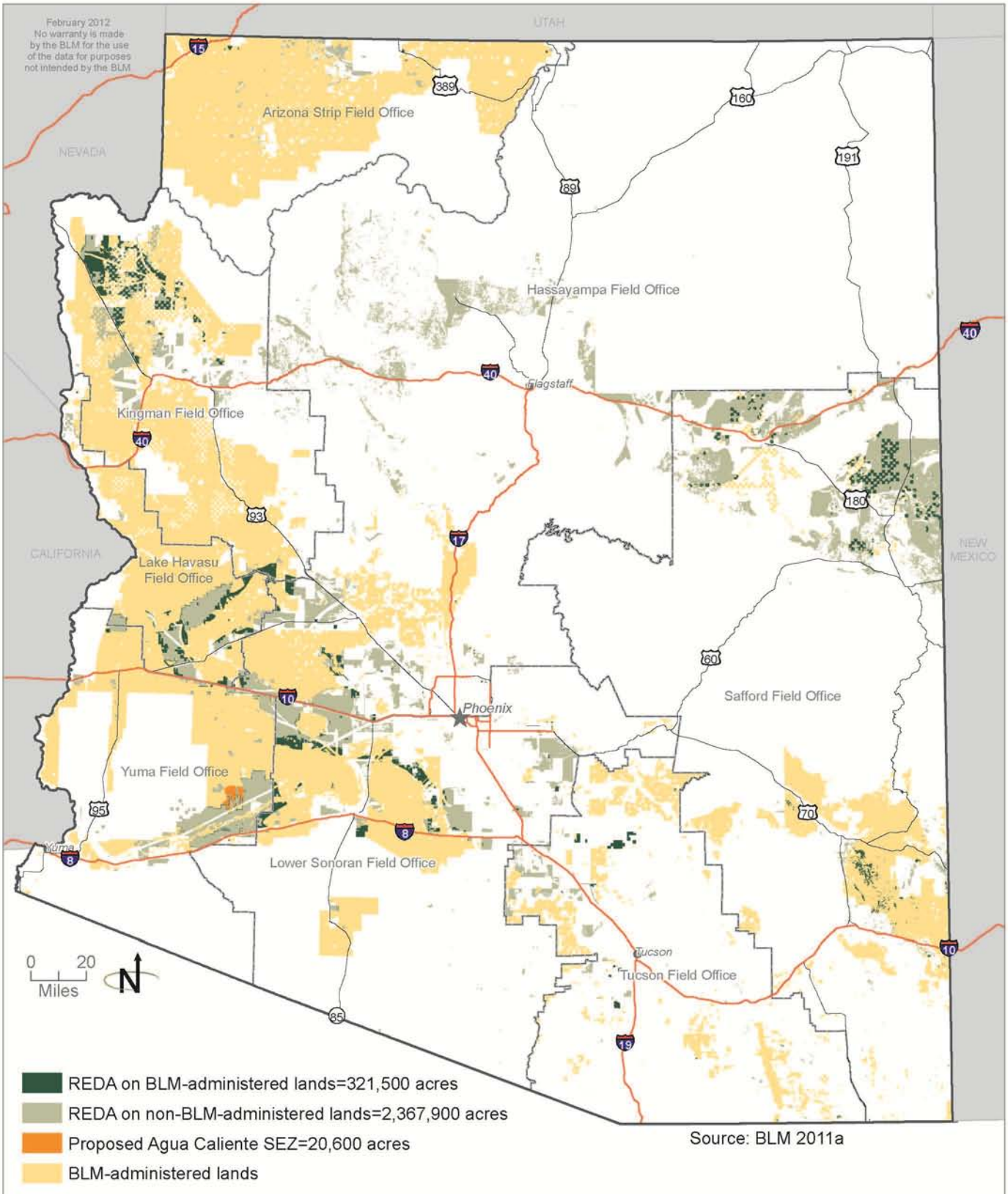


Source: BLM 2011a

Figure 2-3

Alternative 1: Maximum REDA on BLM-Administered Lands

Alternative 1 includes low resource sensitivity areas, RDEP nominated sites, and proposed Agua Caliente Solar Energy Zone (SEZ).



Source: BLM 2011a

Figure 2-4

BLM-Administered Lands). The BLM available lands, management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives would be applied to the BLM-administered lands identified as the Maximum REDA in this alternative.

Table 2-3, Alternative 1: Acres within Maximum REDA and Proposed Agua Caliente SEZ, outlines the number of acres identified as low resource sensitivity areas and RDEP-nominated disturbed sites as distributed across BLM-administered lands and all other non-BLM-administered lands under Alternative 1.

Table 2-3
Alternative 1: Acres within Maximum REDA and Proposed Agua Caliente SEZ

	BLM-Administered Land (acres)	Non-BLM-Administered Land (acres)
REDA (low resource sensitivity areas and RDEP-nominated disturbed sites[6])	321,500	2,367,900
Proposed Agua Caliente SEZ	20,600	0
Total	*342,100*	*2,367,900*

Agua Caliente Solar Energy Zone

The BLM is proposing to identify the Agua Caliente SEZ. Lands that are identified as a SEZ will be given priority for utility-scale solar energy development. As defined in the Solar PEIS, a SEZ is an area with few impediments to utility-scale production of solar energy where BLM would prioritize solar energy and associated transmission infrastructure development. The DOI and BLM Arizona staff provided initial criteria to guide identification of potential suitable parcels, including lands that:

- Were located near existing transmission with capacity or designated corridors;
- Were located near existing roads and other infrastructure;
- Generally had a slope of 1 to 2 percent or less;
- Contained a large continuous tract of BLM-administered land with a minimum of 2,500 acres;
- Had limited known environmental constraints; and

[6] Information on specific nominated sites is available in **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites.

- Were near an existing solar development on previously disturbed lands.

Based on these criteria, the proposed Agua Caliente SEZ in **Figure 2-1**, Proposed Agua Caliente SEZ, is the defined analysis area and encompasses 20,600 acres. While the SEZ's boundary may change once analysis is completed, for the purposes of this analysis, the entire 20,600 acres will be analyzed under Alternative 1. The final Agua Caliente SEZ boundary will be defined in the ROD for this EIS. The 20,600 acres for this proposed SEZ footprint is the maximum area available and was based upon large contiguous tracts of BLM-administered land that had limited known environmental constraints, met all of the above-listed criteria, and is large enough to allow for maximum flexibility in micro-siting of a project and any necessary mitigation measures to reduce impacts of multiple projects. Any development of the proposed Agua Caliente SEZ would be required to follow the requirements of the Solar Energy Program from the Solar PEIS and management actions, design features, and BMPs noted in **Section 2.3.2**, Elements Common to All Action Alternatives. Additionally, the BLM would petition the Secretary of the Interior to withdraw 20,600 acres in the proposed Agua Caliente SEZ from settlement, sale, location, or entry under the general land laws, including the mining laws, to protect and preserve the area for future solar energy development.

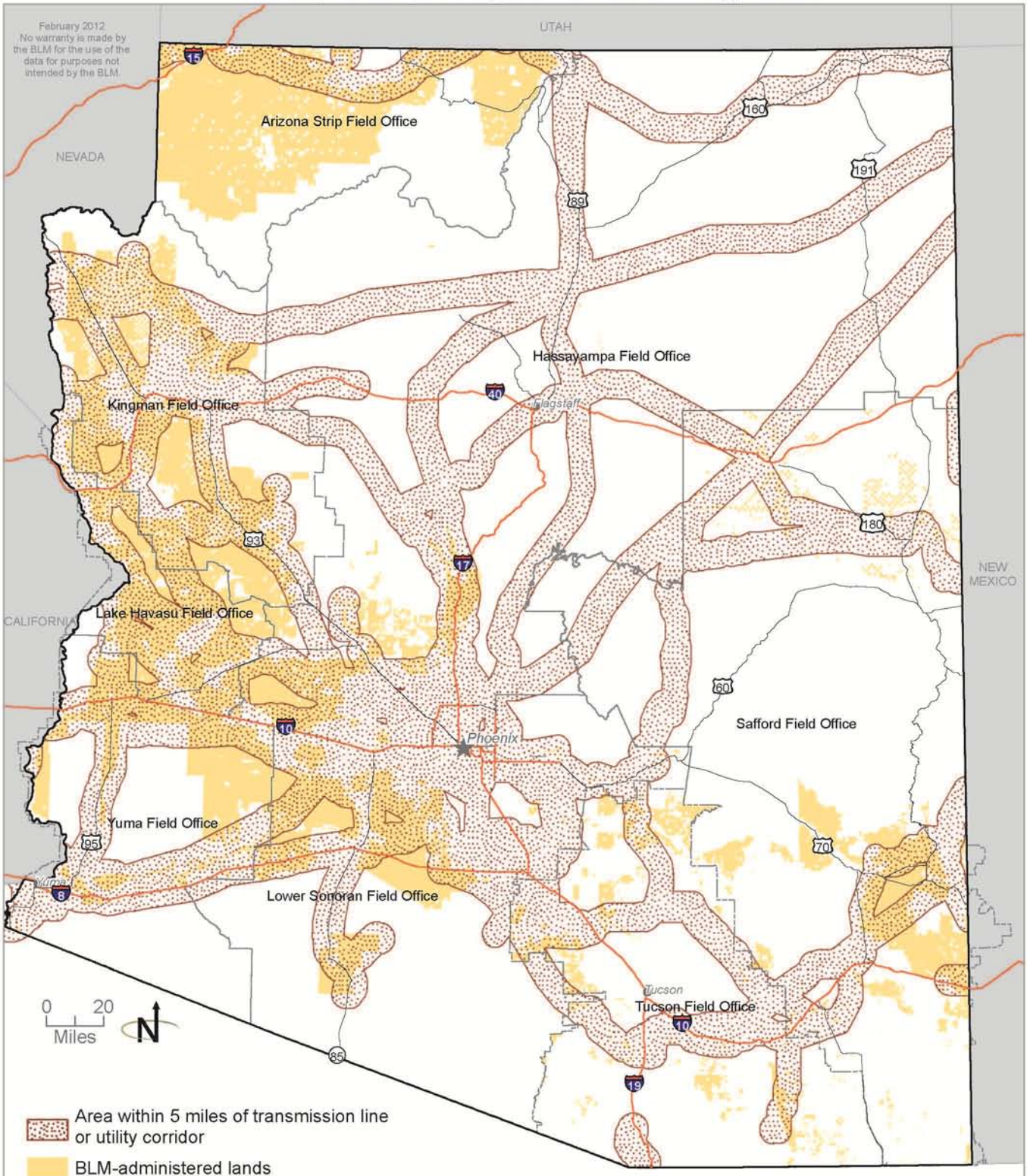
2.3.4 Alternative 2: Transmission Line and Utility Corridor REDA

This alternative responds to scoping comments that wanted the BLM to find renewable energy facility locations close enough to transmission to make it efficient and cost effective to bring the energy on-line and deliver it to the people who need it. This alternative seeks to reduce environmental impacts by focusing renewable energy development on lands within reasonable proximity to designated utility corridors and existing or certified transmission lines. It was developed in coordination with the ACC and utility companies to determine how far away a renewable energy project could be from an existing transmission line to make it efficient and cost effective. This alternative allows flexibility to practicably locate generation sites at a distance from population utilizing existing and planned transmission.

For this alternative, the BLM started with the Maximum REDA lands (Alternative 1), and then narrowed them further to lands within five miles of an existing or planned transmission line, including: (1) BLM-designated utility corridors, including the West Wide Energy Corridors; (2) existing transmission lines 230 kilovolt (kV) or greater; and (3) reasonably foreseeable proposed transmission lines 230 kV or greater (**Figure 2-5**, Alternative 2: Transmission Line and Utility Corridor REDA - Areas Eliminated from Consideration, and **Figure 2-6**, Alternative 2: Transmission

Alternative 2: Transmission Line and Utility Corridor REDA - Areas Eliminated from Consideration

Alternative 2 eliminates REDA not within 5 miles of existing or certified transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, and designated BLM West Wide Energy Corridors.

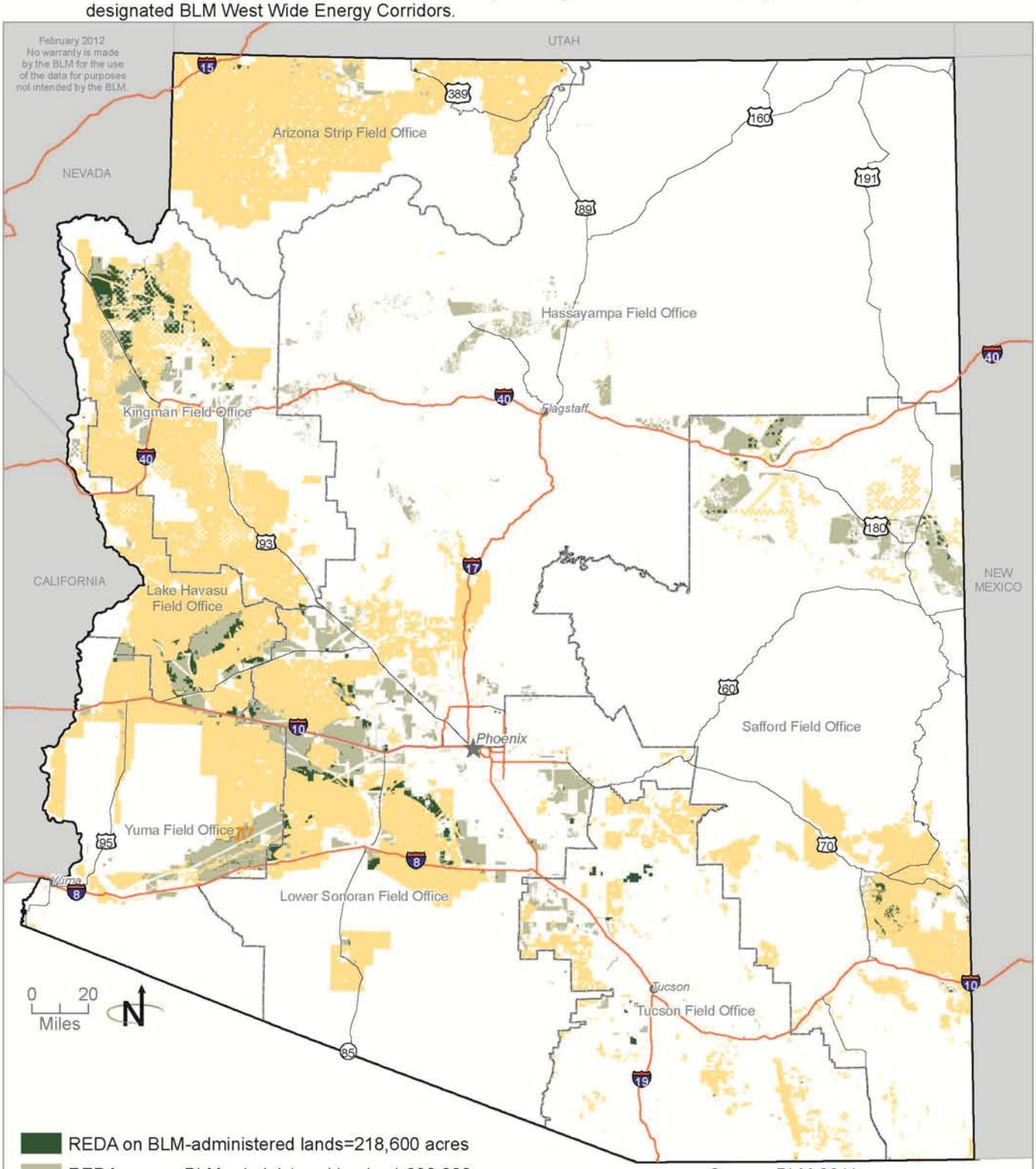


Source: BLM 2011b, POWERmap, powermap.platts.com @2008 Platts, A Division of the McGraw-Hill Companies. Transmission line data are lines greater than 230 kV and verified with assistance from Arizona Public Service Company, Salt River Project, and Bing Maps.

Figure 2-5

Alternative 2: Transmission Line and Utility Corridor REDA on BLM-Administered Lands

Alternative 2 includes low resource sensitivity areas, RDEP nominated sites, and proposed Agua Caliente Solar Energy Zone (SEZ). Alternative 2 also includes REDA within 5 miles of existing or certified transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, and designated BLM West Wide Energy Corridors.



Source: BLM 2011a

Figure 2-6

Line and Utility Corridor REDA on BLM-Administered Lands). The reasonably foreseeable proposed transmission lines are only those that are certified routes by the ACC. The BLM lands available, management actions, design features, and BMPs spelled out in **Section 2.3.2**, Elements Common to All Action Alternatives would be applied to the BLM-administered lands identified as the Transmission Line and Utility Corridor REDA in this alternative. **Table 2-4**, Alternative 2: Acres within Transmission and Utility REDA and Proposed Agua Caliente SEZ, outlines the number of acres identified as low resource sensitivity areas and RDEP-nominated disturbed sites as distributed across BLM-administered lands and all other, non-BLM-administered lands under Alternative 2.

Table 2-4
Alternative 2: Acres within Transmission and Utility REDA and Proposed Agua Caliente SEZ

	BLM-Administered Land (acres)	Non-BLM-Administered Land (acres)
REDA	218,600	1,680,600
Proposed Agua Caliente SEZ	6,770	0
Total	*225,370*	*1,680,600*

Agua Caliente Solar Energy Zone

Under Alternative 2, the footprint of the Agua Caliente SEZ would be reduced to 6,770 acres. This smaller analysis area would meet all of the listed selection criteria noted previously under Alternative 1, but concentrates the development into a smaller footprint. This analysis area fits with the theme for Alternative 2, Transmission and Utility Corridors, namely by emphasizing development in close proximity to the existing and proposed transmission lines, constructed access roads, and existing renewable energy projects. This resulted in removing the northern and western portions of the analysis area as these are further away from transmission, roads and access points, and existing development. This reduced analysis area will be analyzed to determine how well the reduced acreage accommodates flexibility in micro-siting and mitigation. Adjacent generation on private lands may affect logical development units.

As with the larger analysis area, the proposed SEZ's boundary may change once analysis is completed; the final Agua Caliente SEZ boundary would be defined in the RDEP ROD. However, for purposes of analysis, the entire 6,770 acres will be analyzed under Alternative 2. Management of the proposed Agua Caliente SEZ would follow the requirements of the Solar Energy Program from the Solar PEIS and management actions, design

features, and BMPs noted in **Section 2.3.2**, Elements Common to All Action Alternatives. Additionally, the BLM would petition the Secretary of the Interior to withdraw 6,770 acres in the proposed Agua Caliente SEZ from settlement, sale, location, or entry under the general land laws, including the mining laws, to protect and preserve the area for future solar energy development.

2.3.5 Alternative 3: Load Offset REDA

The purpose of Alternative 3 is to reduce disturbance and environmental impacts by keeping energy generation near the point of demand, such as cities, towns, or industrial centers, and to help Arizona meet the following RPS commitments:

- Fifteen (15) percent of energy generation needs to be met by renewable energy sources by 2025;
- Thirty (30) percent of that 15 percent is to come from distributed renewable resources; and
- One-half of the distributed renewable energy requirement is to come from residential applications, and the remaining one-half is to come from non-residential, non-utility applications.

Keeping energy generation near the point of demand will result in the following:

- Offset urban, rural, or industrial demand by serving both large and smaller loads;
- Reduce load required from the larger power grid, thereby allowing routing to other locations using existing transmission;
- Provide opportunities for utility-scale and distributed energy;
- Promote the development of renewable energy industrial parks near Palo Verde Nuclear Generating Station and the town of Gila Bend; and
- Help Arizona meet its RPS commitments.

The BLM considered only those lands identified under Alternative 1 within a 10-mile area around all incorporated cities in Arizona (ALRIS 2011a), a 5-mile area around the Central Arizona Project ROW and known irrigation sources, a 20-mile area around the Palo Verde Nuclear Generating Station, and a 20-mile area around the town of Gila Bend (**Figure 2-7**, Alternative 3: Load Offset REDA - Areas Eliminated from Consideration, and **Figure 2-8**, Alternative 3: Load Offset REDA on BLM-Administered Lands).

Alternative 3: Load Offset REDA - Areas Eliminated from Consideration

Alternative 3 eliminates REDA not within 10 miles of Arizona incorporated cities, not within 5 miles of US Bureau of Reclamation (BOR) Central Arizona Project right-of-way and irrigation pumping sites, and not within 20 miles of Palo Verde Nuclear Power Plant and the town of Gila Bend.

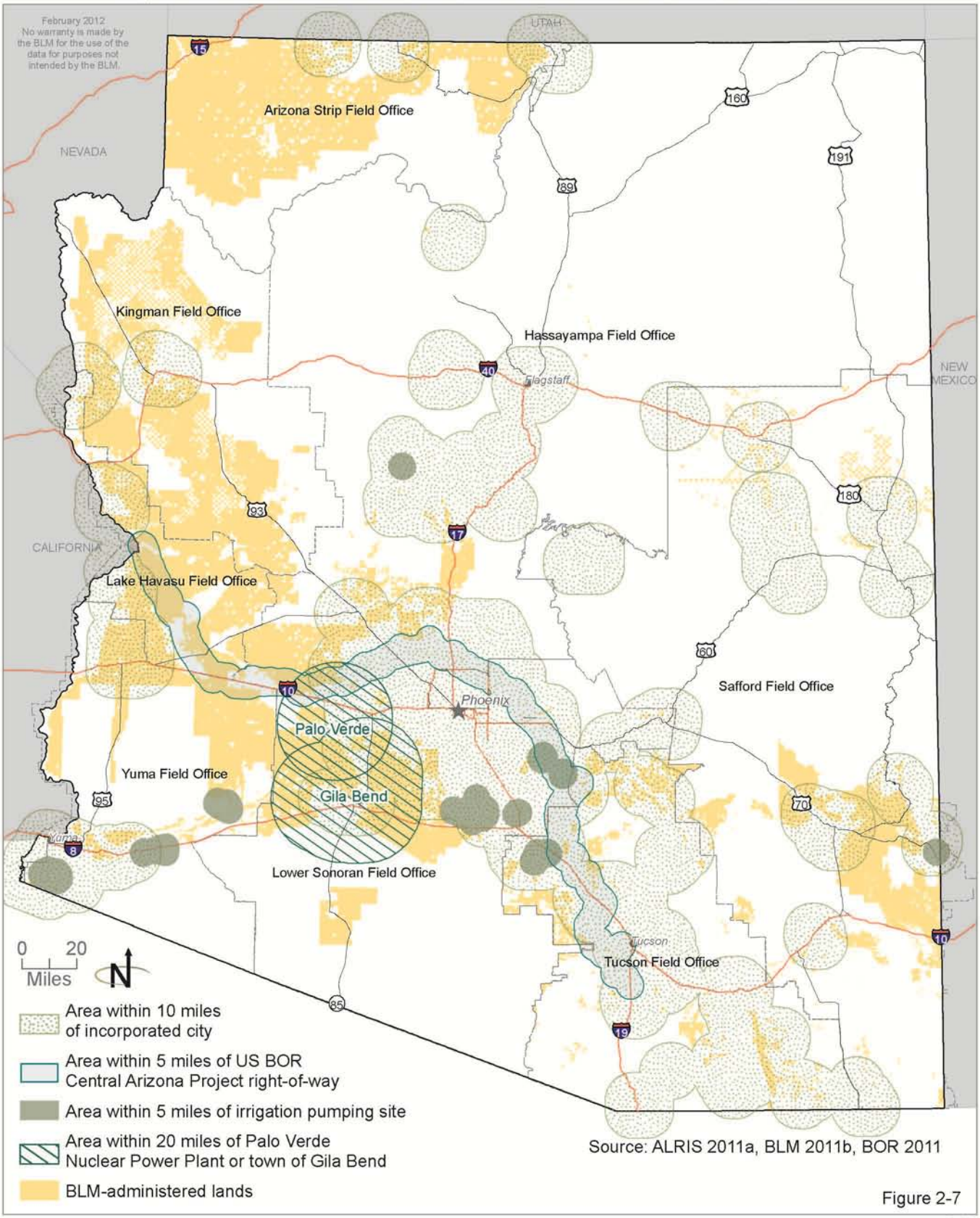
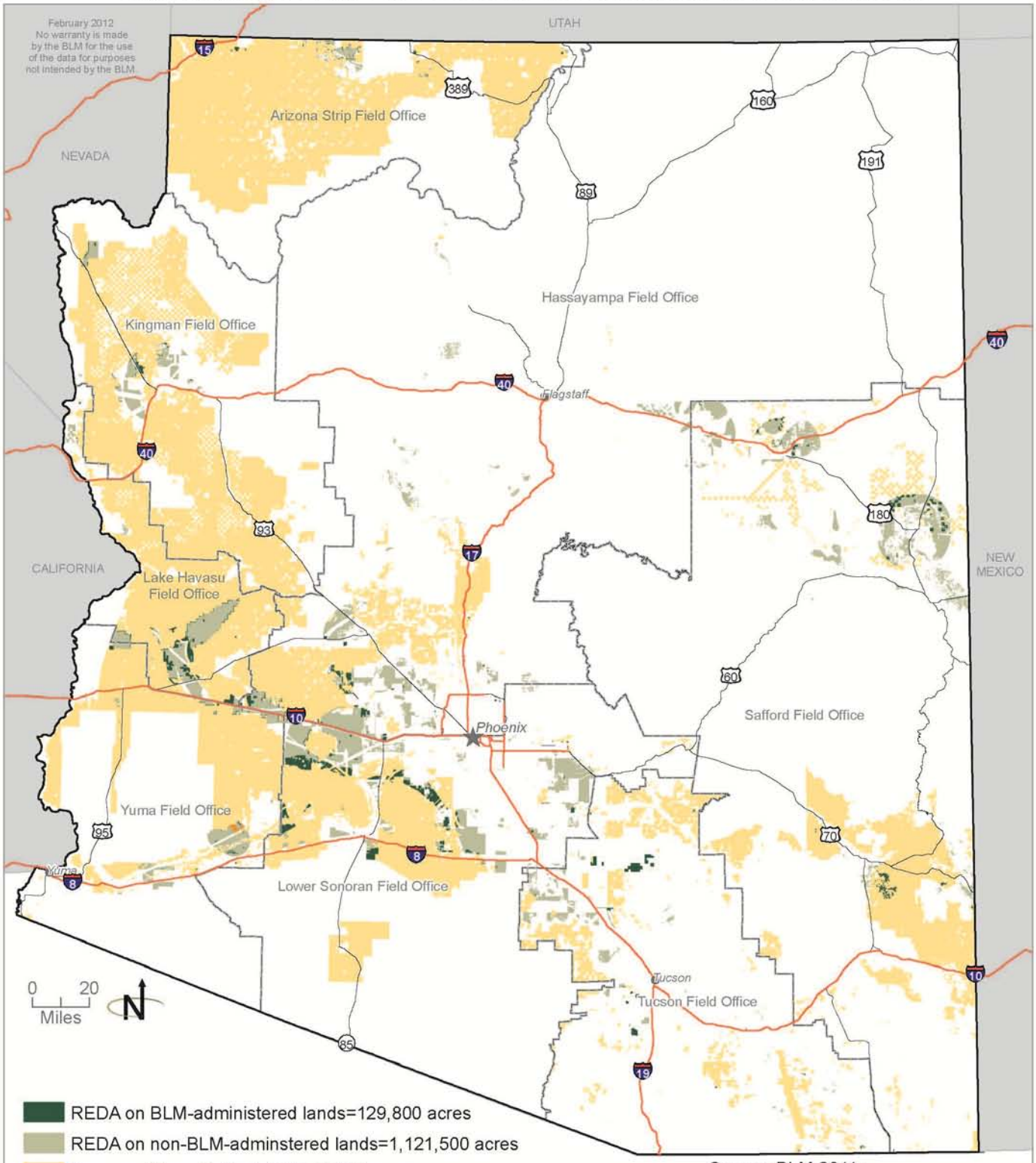


Figure 2-7

Alternative 3: Load Offset REDA on BLM-Administered Lands

Alternative 3 includes low resource sensitivity areas, RDEP nominated sites, and proposed Agua Caliente Solar Energy Zone (SEZ). Alternative 3 also includes REDA within 10 miles of Arizona incorporated cities, 5 miles of US Bureau of Reclamation Central Arizona Project right-of-way and irrigation pumping sites, and 20 miles of Palo Verde Nuclear Power Plant and the town of Gila Bend.



Source: BLM 2011a

Figure 2-8

Section 2.3.2, Elements Common to All Action Alternatives describes all of the management actions, design features, and BMPs that are included in this alternative. **Table 2-5**, Alternative 3: Acres within Load Offset REDA and Proposed Agua Caliente SEZ, outlines the number of acres identified as low resource sensitivity areas and RDEP-nominated disturbed sites as distributed across BLM-administered lands and all other, non-BLM-administered lands under Alternative 3.

Table 2-5
Alternative 3: Acres within Load Offset REDA and Proposed Agua Caliente SEZ

	BLM-Administered Land (acres)	Non-BLM-Administered Land (acres)
REDA	129,800	1,121,500
Proposed Agua Caliente SEZ	2,760	0
Total	*132,560*	*1,121,500*

Agua Caliente Solar Energy Zone

Under Alternative 3, the footprint of the proposed Agua Caliente SEZ would be reduced to 2,760 acres. This smaller analysis area would meet all of the listed selection criteria noted previously under Alternative 1, but concentrates the development into a smaller footprint. The analysis area fits with the theme for Alternative 3 of keeping energy generation close to load centers of the local agricultural lands and nearby communities such as Yuma. As seen on **Figure 2-8**, Alternative 3: Load Offset REDA on BLM-Administered Lands, only the small area in the southwestern portion of the largest proposed SEZ footprint would fall into this alternative. This reduced analysis area will be analyzed to determine how well the reduced acreage accommodates flexibility in micro-siting and mitigation. Adjacent generation on private lands may affect logical development units.

As with the larger analysis areas described for Alternatives 1 and 2, the proposed SEZ's boundary may change once analysis is completed; the final Agua Caliente SEZ boundary would be defined in the RDEP ROD. Management of the proposed Agua Caliente SEZ would follow the requirements of the Solar Energy Program from the Solar PEIS and management actions, design features, and BMPs noted in **Section 2.3.2**, Elements Common to All Action Alternatives. Additionally, the BLM would petition the Secretary of the Interior to withdraw 2,760 acres in the proposed Agua Caliente SEZ from settlement, sale, location, or entry under the general land laws, including the mining laws, to protect and preserve the area for future solar energy development.

2.3.6 Alternative 4: Water Conservation and Protection REDA

The Water Conservation and Protection REDA alternative is intended to respond to public concerns over water availability in Arizona, potential effects on other water users, and how renewable energy facilities will impact water resources. It focuses on avoiding impacts on sensitive surface watersheds, protecting and maintaining groundwater quality and quantity, and reducing consumptive use of water.

Alternative 4 was developed from the Maximum REDA (Alternative 1). While the Maximum REDA (Alternative 1) addresses some water issues, this alternative goes further by proposing water protection zones that provide additional design features to protect water resources in areas with known water supply issues. Specific data used to evaluate and map the water protection zones is presented in **Chapter 3**, Affected Environment.

The water protection zones are described in **Table 2-6**, Water Protection Zones and shown on **Figure 2-9**, Alternative 4: Water Conservation and Protection Zones REDA with Proposed Water Resource Protections, **Figure 2-10**, Alternative 4: Water Conservation and Protection REDA on BLM-Administered Lands, and **Figure 2-11**, Alternative 4: Water Conservation and Protection REDA on Non-BLM-Administered Lands. The BLM management actions, design features, and BMPs in this alternative would be the same as those listed under **Section 2.3.2**, Elements Common to All Action Alternatives with the addition of those design features listed under each zone in **Table 2-6**.

As part of the required water resources mitigation and monitoring plan (see the water design features in **Appendix B**, Design Features and Best Management Practices), applicants could include water conservation and replenishment techniques such as importing water, treating and using brackish water, capturing and using storm water runoff, water retirement, use of recycled or waste water, and vegetation treatments (such as tamarisk removal). **Table 2-7**, Alternative 4: Acres within Water Protection Zones for REDAs and the Proposed Agua Caliente SEZ, outlines the number of acres identified under each zone.

Table 2-6
Water Protection Zones

Water Protection Zone 3 (WPZ 3) – Represents the highest level of water resource protections and would apply to basins currently in overdraft that have long-term groundwater sustainability issues at baseline rates of groundwater consumption based on the criteria listed below.

Criteria	Design Features
• Groundwater demand exceeds natural recharge AND one or more of the following: – Ratio of water demand to water in storage is less than or equal to 1:500 – Mean negative water level change rate is greater than -2 feet per year in one or more sub-basins • San Pedro Priority Watershed to meet management objectives of the San Pedro Riparian National Conservation Area	All activities subject to applicable features, plus the following (applies only to new water developments): • De minimis use only (e.g., drinking water, solar panel washing, etc.) • Annual consumption shall not exceed 55 acre-feet per year

Water Protection Zone 2 (WPZ 2) – Represents a moderate level of water resource protections and would apply to groundwater basins, surface watersheds, and other areas based on the criteria listed below.

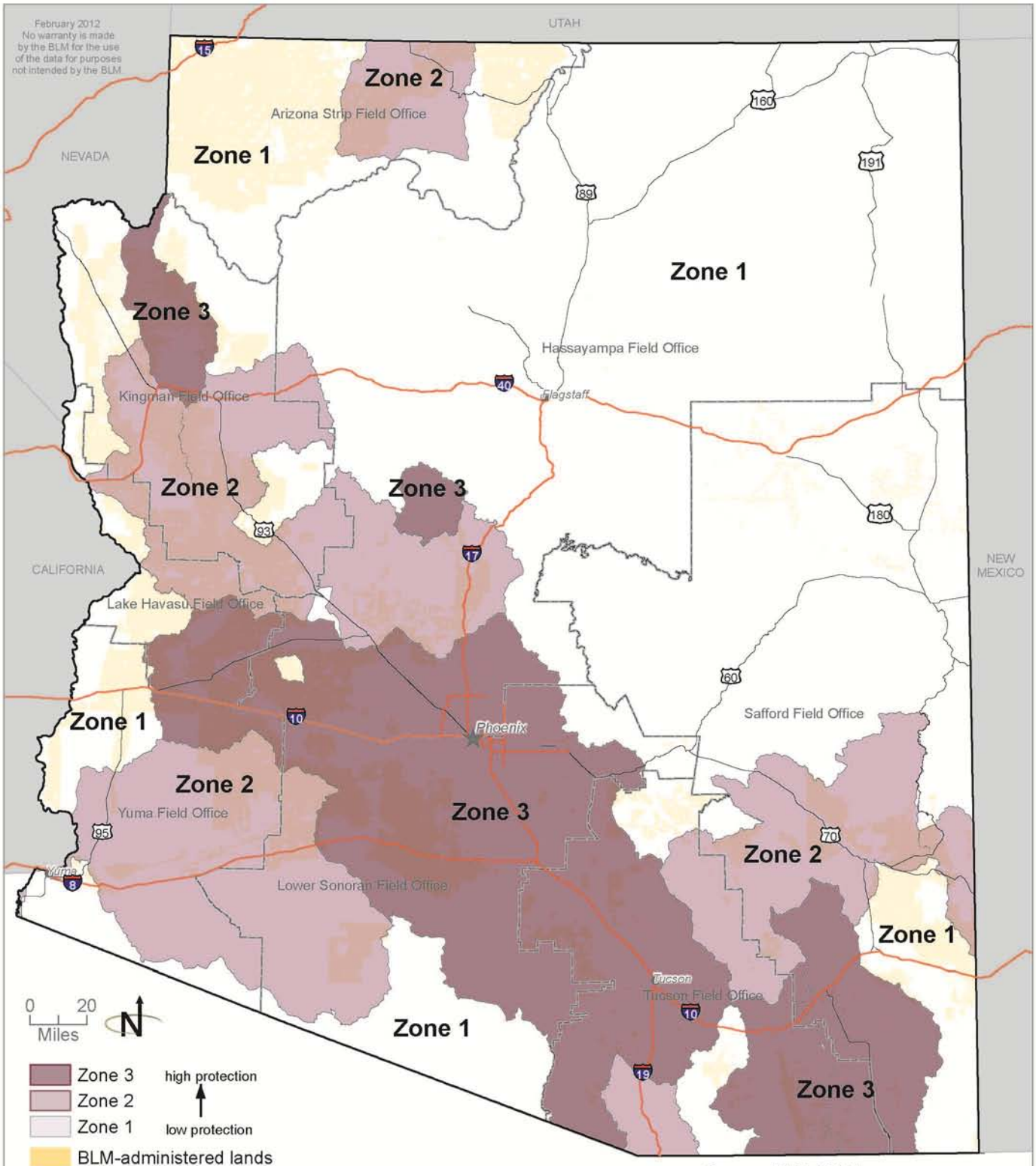
Criteria	Design Features
• Groundwater demand exceeds natural recharge AND one or more of the following: – Ratio of water demand to water in storage is less than or equal to 1:1,000 – Mean negative water level change rate is greater than -0.1 feet per year in one or more sub-basins. • Environmental Protection Agency Sole Source Aquifers • Bureau of Land Management Priority Watersheds	All activities subject to applicable features, plus the following (applies only to new water developments): • Industrial water use limited to dry-cooling technologies

Water Protection Zone 1 (WPZ 1) – No additional levels of protection besides the standard design features as discussed in **Section 2.3.2**, Elements Common to All Action Alternatives
Areas where adequate data is not readily available to evaluate against the criteria would, at a minimum, have Zone 1protections. Additional protections may be afforded to these areas as specific project applications are received and the areas are further assessed.

Criteria	Design Features
• Groundwater demand less than natural recharge.	• All activities subject to applicable design features as discussed in **Section 2.3.2**, Elements Common to All Action Alternatives.

Alternative 4: Water Conservation and Protection Zones REDA with Proposed Water Resource Protections

Alternative 4 categorizes REDA into Water Protection Zones of 1, 2, or 3. Zones were created based on information found in Table 2-6.



Source: BLM 2011b

Figure 2-9

Alternative 4: Water Conservation and Protection REDA on BLM-Administered Lands

Alternative 4 includes low resource sensitivity areas, RDEP nominated sites, and proposed Agua Caliente Solar Energy Zone (SEZ). Alternative 4 categorizes REDA into Water Protection Zones 1, 2, or 3. Zone 1 affords the least protection and Zone 3 the highest. RDEP nominated sites are considered Zone 1.

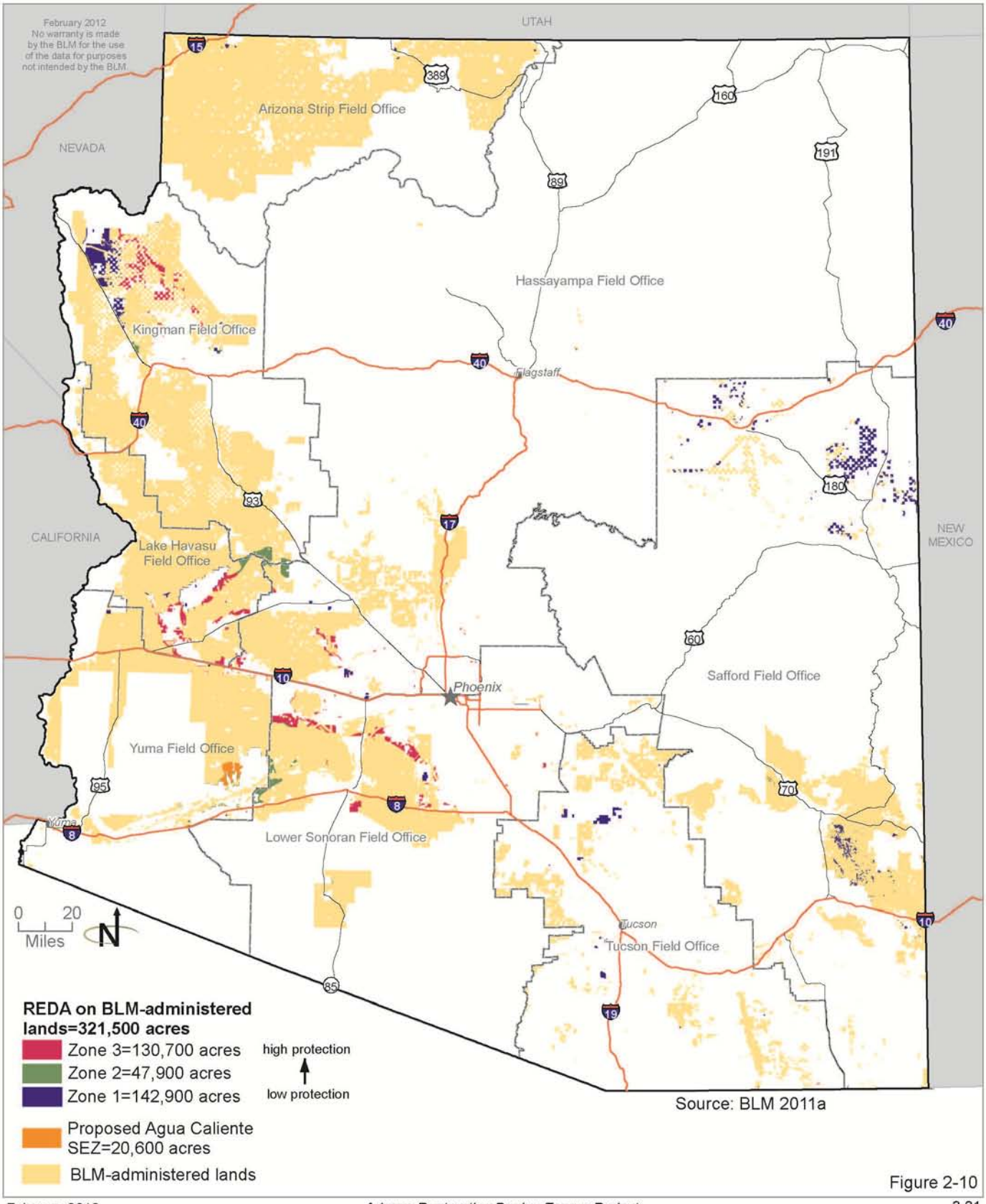
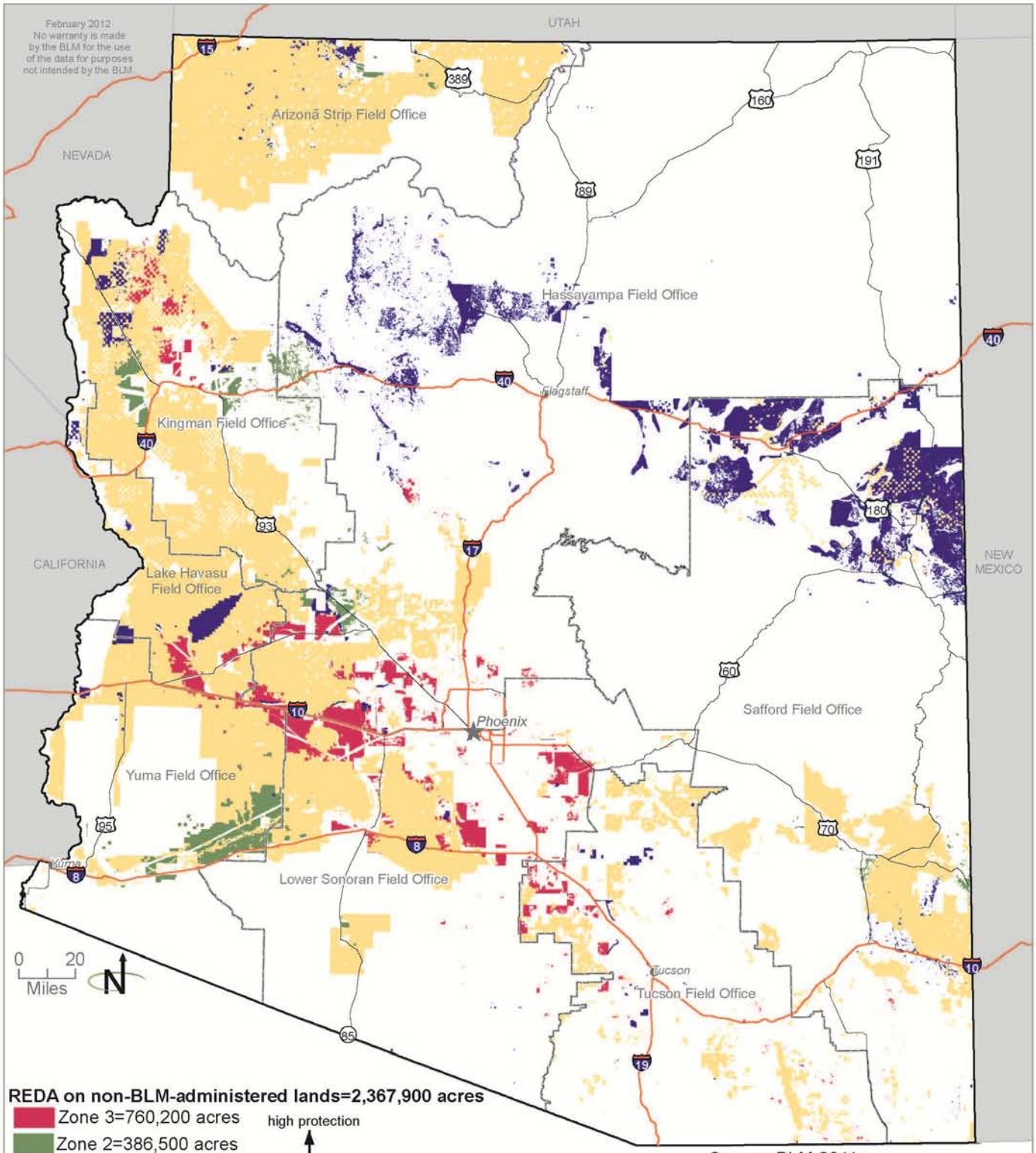


Figure 2-10

Alternative 4: Water Conservation and Protection REDA on Non-BLM-Administered Lands

Alternative 4 categorizes REDA into Water Protection Zones 1, 2, or 3. Zone 1 affords the least protection and Zone 3 the highest. RDEP nominated sites are considered Zone 1.



No decisions will be made on non-BLM-administered lands.

Figure 2-11

Table 2-7
Alternative 4: Acres within Water Protection Zones for REDAs and the Proposed Agua Caliente SEZ

	BLM-Administered Land (acres)	Non-BLM-Administered Land (acres)
Water Protection Zone 3	130,700	760,200
Water Protection Zone 2	47,900	386,500
Water Protection Zone 1	142,900	1,221,200
Total REDA	*321,500*	*2,367,900*
Proposed Agua Caliente SEZ (Water Resource Protection Zone 2)	20,600	0
Total REDA and SEZ	*342,100*	*2,367,900*

Agua Caliente Solar Energy Zone

The proposed Agua Caliente SEZ analysis area is the same as described in Alternative 1, Maximum REDA. As the area considered for the REDA in this alternative is the maximum area, the footprint for the proposed SEZ was also kept to the maximum area. The 20,600-acre area was based upon the same criteria noted under Alternative 1 for the proposed Agua Caliente SEZ. Management of the proposed Agua Caliente SEZ would follow the requirements of the Solar Energy Program from the Solar PEIS and management actions, design features, and BMPs noted in **Section 2.3.2**,

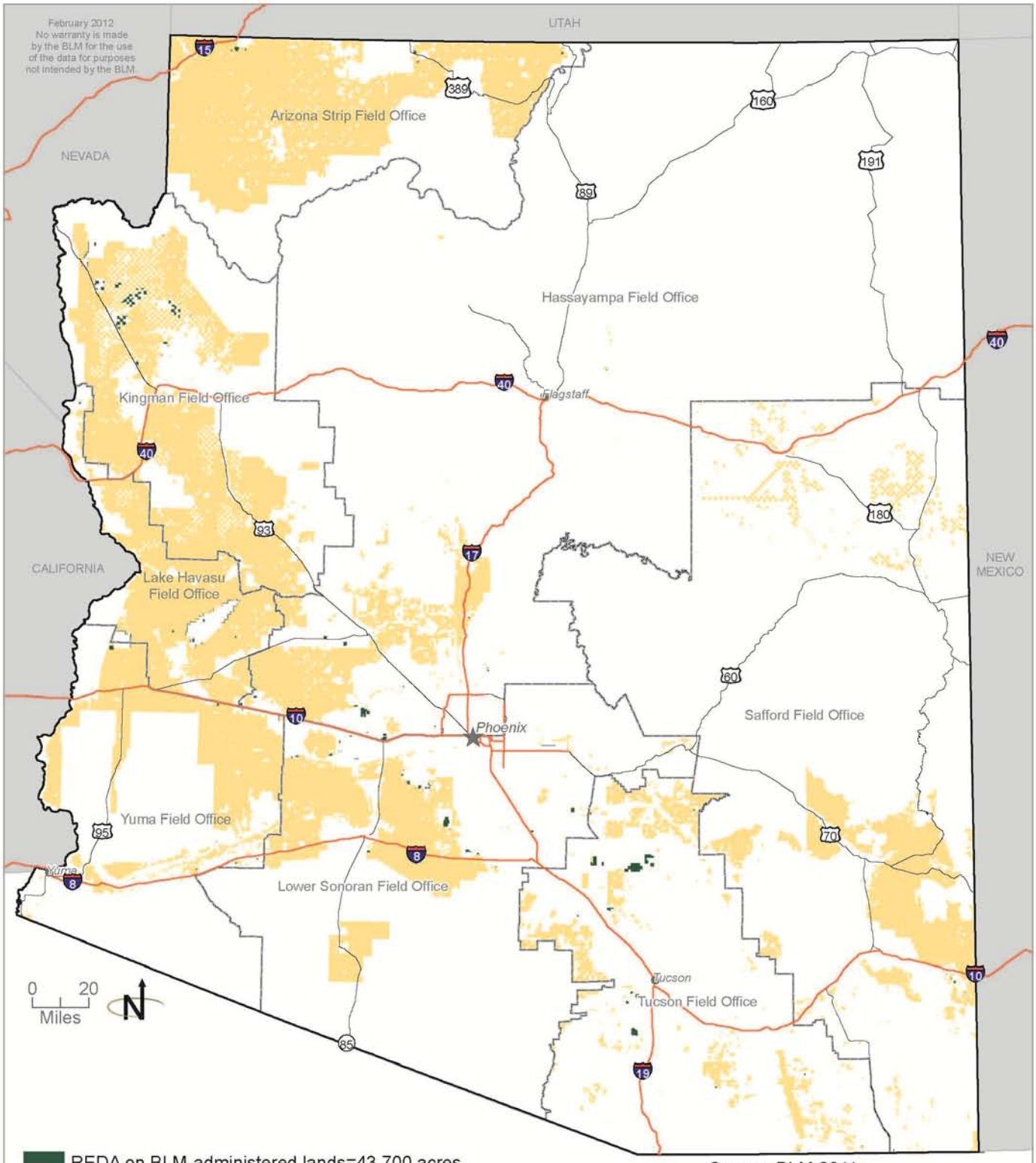
Elements Common to All Action Alternatives. Additionally, the proposed SEZ would include the design features noted under Water Protection Zone 2, as described in **Table 2-6**, Water Protection Zones, above. Similar to Alternative 1, the BLM would petition the Secretary of the Interior to withdraw 20,600 acres in the proposed Agua Caliente SEZ from settlement, sale, location, or entry under the general land laws, including the mining laws, to protect and preserve the area for future solar energy development.

2.3.7 Alternative 5: Land Tenure REDA

The Land Tenure REDA alternative meets the purpose and need for the RDEP in planning for environmentally sound renewable energy development on public lands in Arizona by focusing on lands which prior planning processes have concluded are suitable for disposal. These public lands are both within the Maximum REDA (the area identified in Alternative 1) and have been identified as suitable for disposal in existing land use plans. These lands were identified as suitable for general disposal for a number of

Alternative 5: Land Tenure REDA on BLM-Administered Lands

Alternative 5 includes low resource sensitivity areas and RDEP nominated sites. Alternative 5 includes REDA that have lands identified for disposal under land use plans and emphasizes exchange of public lands with renewable energy potential for lands of high conservation potential.



Disposal lands are only on BLM-administered lands.

Figure 2-12

reasons, including low resource values, previous disturbance, and isolation from larger blocks of public land, which has made managing them as public lands difficult (see **Figure 2-12**, Alternative 5: Land Tenure REDA on BLM-Administered Lands). This would be an option for any RDEP alternative in addition to being considered as a stand-alone option in Alternative 5: Land Tenure REDA.

With the increased emphasis on renewable energy development, including on public lands, this alternative examines two possible options for these disposal lands:

1. Retain and allocate the areas for renewable energy development. Existing policy requires authorizing renewable energy projects with ROW grants, normally with a term of 30 years. Proposed rule-making at the national level may require competitive grants or leases of public lands for renewable energy development to generate additional revenue.
2. Prioritize the disposal of these lands to renewable energy purposes. Add criteria to favor disposal in a manner that creates additional social and environmental benefits (e.g., assist in addressing a water issue, adjusting land patterns to meet public needs).

Because option 2 proposes disposal of public land tracts that could generate public revenues, the following additional disposal criteria focus on creating additional public benefits to offset potential lost revenues:

- Priority disposal would be considered to entities who offer lands of equivalent value in areas of conservation importance such as national monuments, wilderness areas, or priority watersheds.
- A public interest determination would be made in accordance with Section 206(a) of FLPMA for disposals by exchange in association with a renewable energy project.
- Disposals may be considered at any time during the life of the project, and the facility authorized by a ROW grant would be included on the land patent as an encumbrance.
- Disposals may be conducted through a variety of mechanisms, including exchange or sale, with or without third-party facilitation (43 CFR 2201).

As with the other alternatives, the BLM management actions, design features, and BMPs in this alternative would be the same as those listed under **Section 2.3.2**, Elements Common to All Action Alternatives. Under disposal regulations and policy, lands that have been allocated for disposal

would require additional review and public participation prior to completing any transaction.

Table 2-8, Alternative 5: Acres within Land Tenure REDA and Proposed Agua Caliente SEZ, illustrates the number of acres that have already been identified as suitable for disposal and have low resource sensitivity, are RDEP nominated disturbed sites, or are in proposed SEZs in the Solar PEIS and the RDEP.

Table 2-8
Alternative 5: Acres within Land Tenure REDA and Proposed Agua Caliente SEZ

	BLM-Administered Land (acres)
REDA (BLM disposal lands and Nominated Disturbed Sites)	43,700
Proposed Agua Caliente SEZ	0
Total	*43,700*

Agua Caliente Solar Energy Zone

This alternative focuses on the BLM-administered lands that were identified in existing RMPs as available for disposal; since the maximum proposed SEZ footprint did not have any areas identified in the Yuma RMP for disposal, there is no SEZ proposed for Alternative 5.

2.3.8 Alternative 6: Collaborative-Based REDA (Preferred Alternative)

While the previous five alternatives each address some of the aspects of renewable energy issues and concerns brought forth during scoping, Alternative 6: Collaborative-Based REDA incorporates all of the concepts, issues, and protections from the other five alternatives into a "blended" alternative. Once the other five alternatives were conceptually developed, the BLM made them available for review by stakeholders, the public, and cooperating agencies. Based on this outreach, the BLM refined the alternatives and developed the Collaborative-Based REDA that includes:

- Areas that are more likely to have fewer resource conflicts that may affect development;
- Areas close enough to transmission to make it efficient and cost effective to bring the energy on-line;
- Energy generation areas near the point of demand, such as cities, towns, or industrial centers; and
- Additional resource protection measures:

- Water resource design features noted in **Table 2-6**, Water Protection Zones; and
- Prioritize the disposal of these lands to renewable energy purposes, and adding criteria to favor disposal in a manner that creates additional social and environmental benefits (see Alternative 5).

This alternative combines the transmission areas and load centers data from Alternatives 2 (Transmission REDA) and 3 (Load Offset REDA). Locating areas close to transmission and load centers provides the context for where electricity demand is and where renewable energy projects may be developed in the future. Resource protection elements were added to these lands, specifically by including the water resource protections (design features) from Alternative 4 to address the water availability concerns, and prioritizing available disposal lands for renewable energy purposes that would favor disposal in a manner that creates additional social and environmental benefits (Alternative 5). **Figure 2-13**, Alternative 6: Collaborative-Based REDA - Areas Eliminated from Consideration, **Figure 2-14**, Alternative 6: Collaborative-Based REDA on BLM-Administered Lands, and **Figure 2-15**, Alternative 6: Collaborative-Based REDA on Non-BLM-Administered Lands give illustration to all of these elements combined to create the Collaborative-Based REDA.

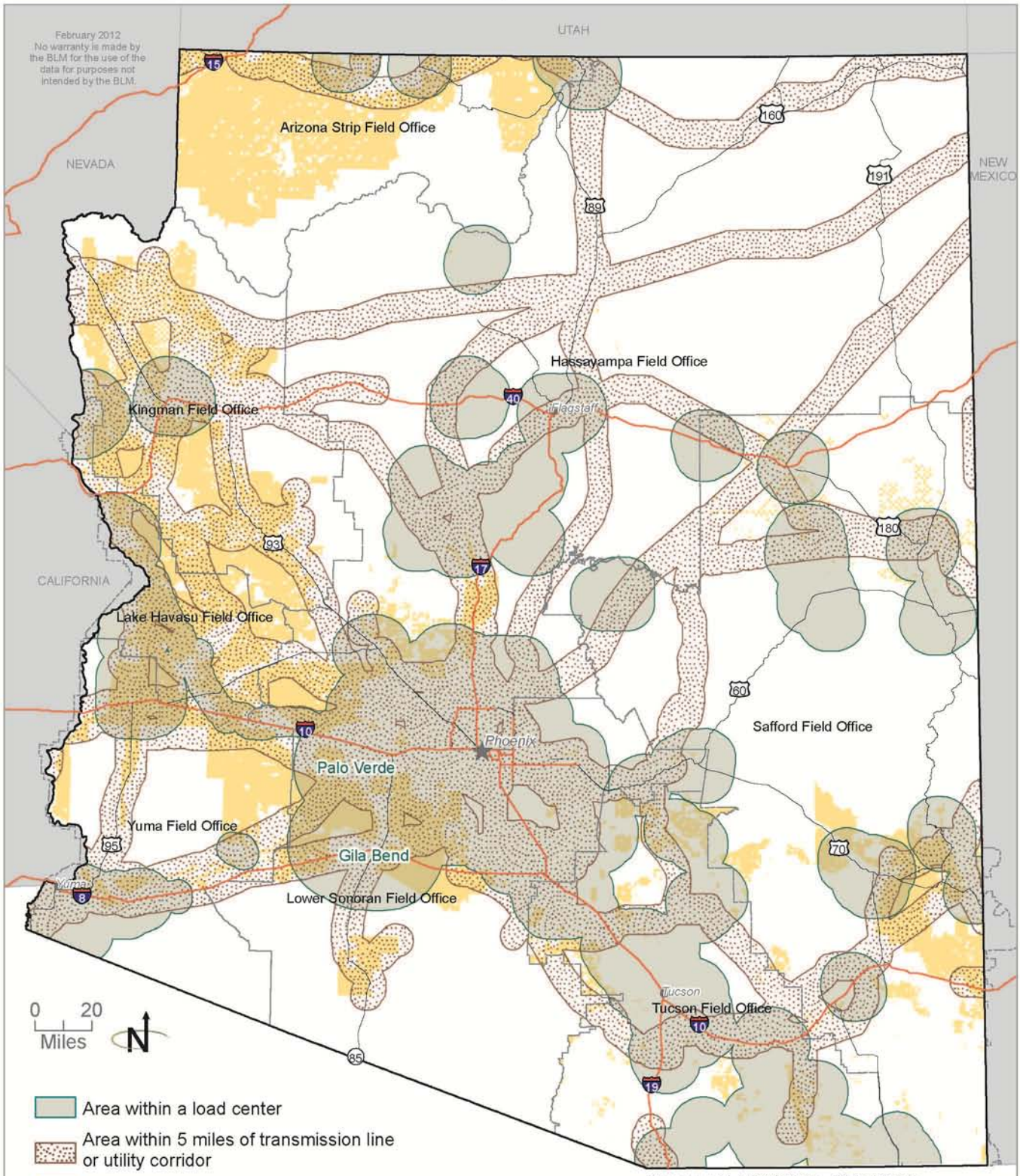
In terms of how the Collaborative-Based REDA would be managed, the management actions, design features, and BMPs in this alternative would be the same as those listed under **Section 2.3.2**, Elements Common to All Action Alternatives and would include the water resource design features from Alternative 4 and prioritize available disposal lands to renewable energy purposes with criteria to favor disposal in a manner that creates additional social and environmental benefits from Alternative 5. **Table 2-9**, Alternative 6: Collaborative-Based REDA and Proposed Agua Caliente SEZ, outlines the number of acres identified as low resource sensitivity areas, RDEP-nominated Disturbed Sites, and Solar PEIS SEZs throughout the state and exclusively on public lands.

Agua Caliente Solar Energy Zone

The proposed Agua Caliente SEZ analysis area is the same as described in Alternative 2, Transmission Line and Utility Corridor REDA. This smaller analysis area would meet all of the listed selection criteria noted previously under Alternative 1, but concentrates the development into a smaller footprint. The analysis area fits with the theme for Alternative 6 of keeping energy generation close to transmission and load centers, while including the additional environmental protections for water resources.

Alternative 6: Collaborative-Based REDA - Areas Eliminated from Consideration

Alternative 6 eliminates REDA that is not within 5 miles of existing or certified transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, designated BLM West Wide Energy Corridors, and US Bureau of Reclamation Central Arizona Project right-of-way and irrigation pumping sites. Additionally, Alternative 6 eliminates REDA not within 10 miles of Arizona incorporated cities and within 20 miles of Palo Verde Nuclear Power Plant and the town of Gila Bend. Alternative 6 also categorizes REDA into Water Protection Zones 1, 2, or 3.

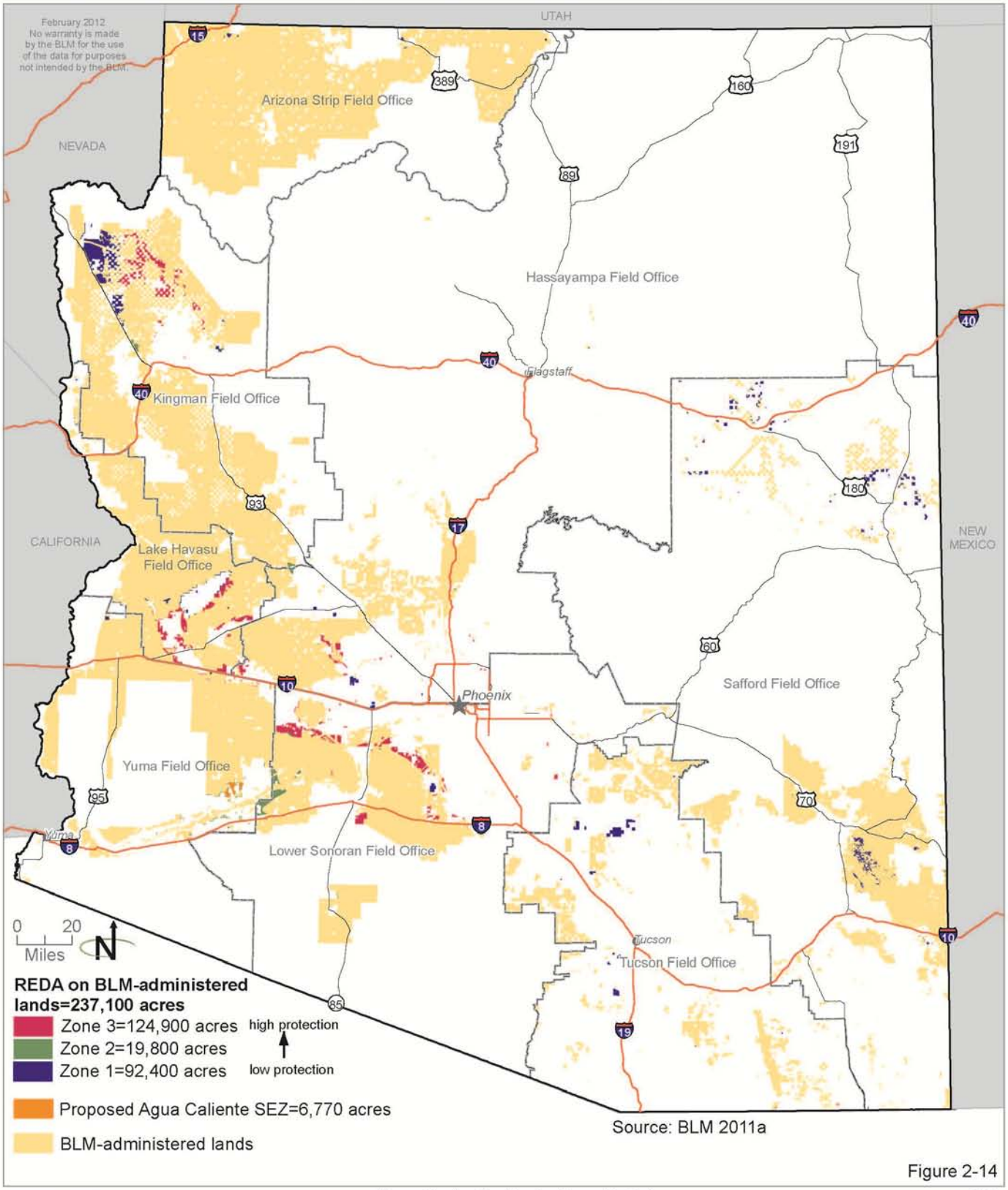


Source: ALRIS 2011a, BLM 2011b, BOR 2011, POWERmap 2010

Figure 2-13

Alternative 6: Collaborative-Based REDA on BLM-Administered Lands

Alternative 6 includes REDA within 5 miles of existing or certified transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, designated BLM West Wide Energy Corridors, and US Bureau of Reclamation Central Arizona Project right-of-way and irrigation pumping sites. Additionally, Alternative 6 includes REDA within 10 miles of Arizona incorporated cities and within 20 miles of Palo Verde Nuclear Power Plant and the town of Gila Bend. Alternative 6 also categorizes REDA into Water Protection Zones 1, 2, or 3 with Zone 1 affording the least protection and Zone 3 the highest.

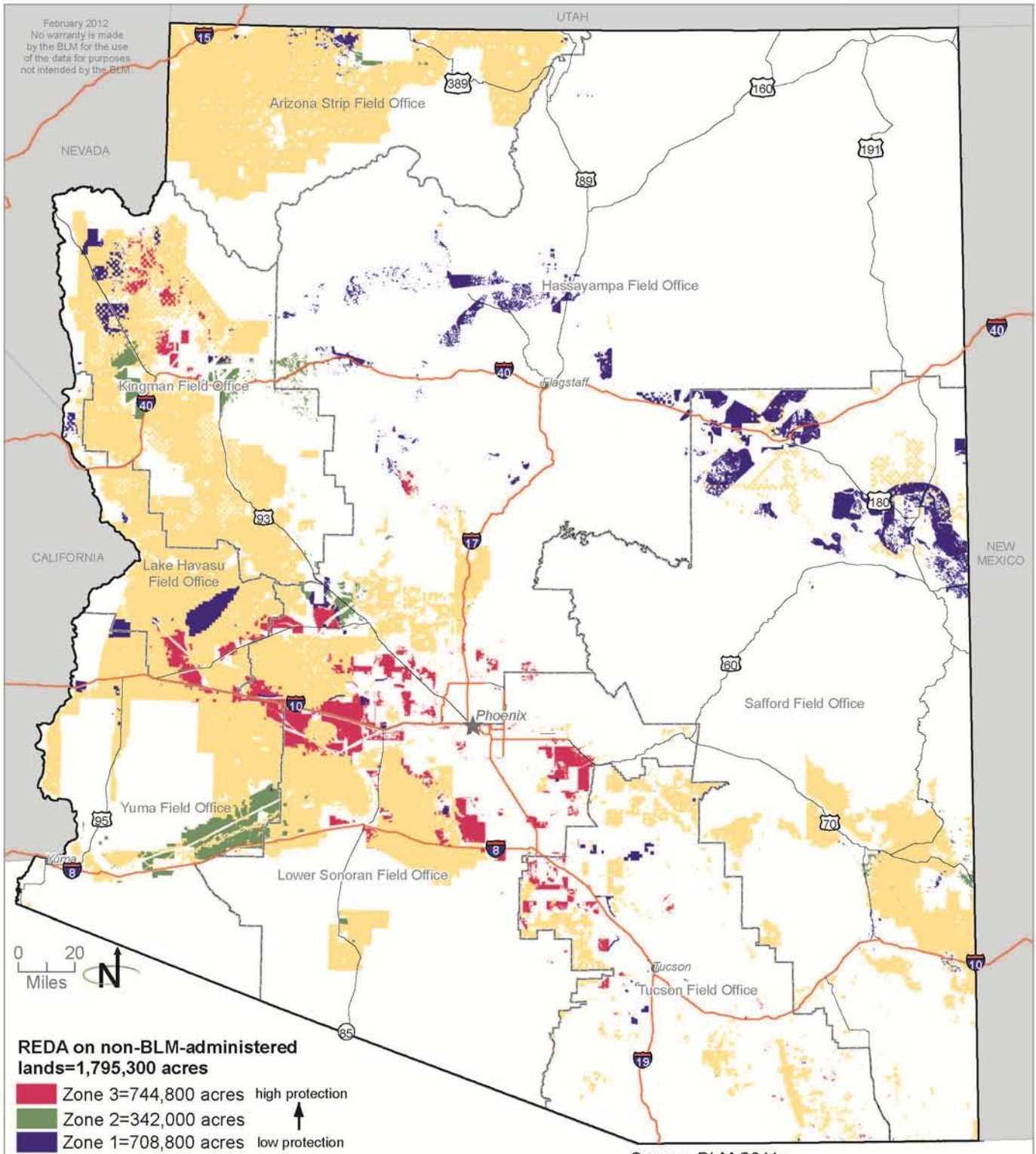


Source: BLM 2011a

Figure 2-14

Alternative 6: Collaborative-Based REDA on Non-BLM-Administered Lands

Alternative 6 includes REDA within 5 miles of existing or proposed transmission lines, either side of the outer boundary of designated Arizona BLM Utility Corridors, designated BLM West Wide Energy Corridors, and US Bureau of Reclamation Central Arizona Project right-of-way and irrigation pumping sites. Additionally, Alternative 6 includes REDA within 10 miles of Arizona incorporated cities and within 20 miles of Palo Verde Nuclear Power Plant and the town of Gila Bend. Alternative 6 also categorizes REDA into Water Protection Zones 1, 2, or 3 with Zone 1 affording the least protection and Zone 3 the highest.



Source: BLM 2011a

No decisions will be made on non-BLM-administered lands.

Figure 2-15

Management of the proposed Agua Caliente SEZ would follow the requirements of the Solar Energy Program from the Solar PEIS and management actions, design features, and BMPs noted in **Section 2.3.2**, Elements Common to All Action Alternatives. Additionally, the proposed SEZ would include the design features noted under Water Protection Zone 2, as described in **Table 2-6**, Water Protection Zones. Similar to Alternative 2, the BLM would petition the Secretary of the Interior to withdraw 6,770 acres in the proposed Agua Caliente SEZ from settlement, sale, location, or entry under the general land laws, including the mining laws, to protect and preserve the area for future solar energy development.

Table 2-9
Alternative 6: Collaborative-Based REDA and Proposed Agua Caliente SEZ

	BLM-Administered Land (acres)	Non-BLM-Administered Land (acres)
Alternative 6: Collaborative Alternative	237,100	1,795,300
Proposed Agua Caliente SEZ (Water Resources Protection Zone 2)	6,770	0
Acreage with Resource Protections		
Water Design Features		
Water Protection Zone 3	124,900	744,800
Water Protection Zone 2	19,800	342,000
Water Protection Zone 1	92,400	708,500
Off-site Conservation		
Lands available for disposal	43,700	N/A

Table 2-10, Summary of Acres for Alternatives, gives the number of REDA acres for each alternative as distributed across all lands and public lands.

Table 2-10
Summary of Acres for Alternatives

	BLM-Administered Land	Non-BLM-Administered Land	Proposed Agua Caliente SEZ
Alternative 1: Maximum REDA	321,500	2,367,900	20,600
Alternative 2: Transmission Line and Utility Corridor REDA	218,600	1,680,600	6,770
Alternative 3: Load Offset REDA	129,800	1,121,500	2,760
Alternative 4: Water Conservation and Protection REDA	321,500	2,367,900	20,600
Alternative 5: Land Tenure REDA	43,700	N/A	0
Alternative 6: Collaborative–Based REDA	237,100	1,795,300	6,770

2.4 PREFERRED ALTERNATIVE

The BLM has identified Alternative 6: Collaborative-Based REDA as the agency's preferred alternative, because it best meets the following criteria:

- Satisfies statutory requirements (true for all alternatives).
- Reflects what the BLM believes to be the best combination of actions to achieve the stated goals.
- Represents the best solution for the purpose and need as described in **Chapter 1**, Introduction.
- Provides the best approach to address the key resource and planning issues.
- Provides resource protection and a viable footprint for energy generation and distribution.
- Includes input from cooperating agencies, collaborating partners, stakeholders, the public, and BLM specialists.

The preferred alternative is the BLM's preliminary preference and does not represent a final BLM decision. The preferred alternative could change between publication of the Draft EIS and Final EIS based on public comments on the Draft EIS, new information, or changes in laws, regulations, or BLM policies. The BLM invites comment on the choice of preferred alternative.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

The range of alternatives developed for RDEP evolved from the issues ascertained through scoping, public outreach, and collaboration with cooperating agencies. The alternatives address a variety of topics, including reuse of disturbed lands, transmission, distributive and utility-scale energy development, and analysis of BLM and other lands. There are a couple of other alternatives that the BLM considered but eliminated from detailed analysis because they did not meet the stated purpose and need (**Section 1.2**, Purpose and Need for the RDEP). These alternatives are summarized below.

Restricting Development to Urban Areas: Suggestions were made to restrict solar and wind energy development to urban areas, such as rooftop solar. The BLM does not have authority to make decisions on non-BLM-administered lands or influence local policies. Likewise, as stated in the purpose and need statement, the BLM needs to identify lands most suitable for renewable energy development. Most BLM lands are located outside of urban areas. While this specific issue has not been incorporated into the EIS as an independent alternative, consideration was given to proximity of available lands to urban areas, load centers, and transmission lines to promote distributive development. Some of the proposed REDAs are located close to urban areas.

Conservation Management: Comments were made to focus an alternative on instituting conservation measures and implementing demand-side management to reduce electrical demand. While this is a viable action to help meet America's energy needs, it does not respond to the purpose and need for agency action in this EIS. In general, conservation initiatives would be designed to reduce energy consumption levels in order to reduce the need for increased electricity generation capacity. Demand-side management would involve specific actions taken by utilities, their regulators, and other entities to induce, influence, or compel consumers to reduce their energy consumption, particularly during periods of peak demand. These efforts are beyond the scope of the BLM's land management responsibilities.

Other Alternatives Considered but Eliminated: Additional comments were brought up regarding very site-specific implementation-level issues. This EIS is a planning document to identify public lands most suitable for renewable energy development. Site-specific implementation-level analysis would be conducted on an application-by-application basis.

2.6 SUMMARY OF THE REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

The RFDS identifies the lands in Arizona that are likely most suitable for the development of solar and wind energy resources, and estimates the acreage of those lands required to support renewable energy projects that would not only meet but exceed the Arizona RPS of 15 percent renewable energy

by 2025. Arizona, given its abundance of solar energy resources, is expected to be a net exporter of renewable energy, and so it is assumed that by 2025 Arizona will generate renewable energy at a level that is twice the amount required by the RPS. In other words, the RFDS estimates that half of the renewable energy generated will stay in-state, while the other half will be exported to neighboring states such as California. The RFDS is neither a planning decision nor the "No Action Alternative" in the EIS; rather, it serves as a technical supporting analysis to be used as a reference. The full RFDS report is available in **Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona.

The purpose of the RFDS is to inform policy makers, BLM decision makers, the general public, and renewable energy developers. All of the groups have an important role in determining allowable uses on lands and in approving or denying a local project proposal. The RFDS allows them to make comments and decisions on an individual project by taking into account how it would fit into the big-picture, planning-level energy and environmental landscape.

BLM's responsibility for permitting renewable energy production sites is based on production occurring on BLM-administered lands; BLM has no authority to permit renewable energy development on non-BLM-administered lands. The RFDS focuses on ground-based, commercial-scale renewable energy projects; it is recognized that Arizona has potential for rooftop solar and cogeneration of renewable energy with conventional energy production facilities, but these could occur without BLM involvement and, therefore, are excluded from the analysis. However, the RFDS provides parallel analyses for BLM-administered lands and for non-BLM-administered lands throughout the state.

2.6.1 Findings and Conclusions

The majority of BLM-administered land that is developable for solar energy projects occurs in the western half of Arizona, with smaller areas identified to the east around Safford and smaller scattered parcels throughout the Tucson Field Office and in the northern portion of the Safford Field Office. Large tracts of land with no known technical or regulatory conflicts are identified along Interstates 8 and 10 to the west of Phoenix, and to the north, south, and west of Highway 389.

Relatively few areas of BLM-administered land are considered developable for wind energy projects across Arizona. These areas occur in several locations within the Arizona Strip Field Office in the northwestern corner of the state, west of Kingman near the California border, an area in the northern portion of the Tucson Field Office, and a scattering of areas in the northern portion of the Safford Field Office, south of Highway 40. No BLM-administered lands were found to contain the highest class of wind

resources (Class 7), and only 69 acres were found to contain the second highest class of wind resources (Class 6). Statistics from the RFDS are summarized in **Table 2-11**, Summary of RFDS Results, below.

Table 2-11
Summary of RFDS Results

Land required to produce 1 GW (solar)	8,000 acres
Land required to produce 1 GW (wind)	28,000 acres (10% of which would be disturbed)
Estimated renewable energy output by 2025	28,642 GWh
Estimated utility scale solar energy maximum production by 2025	9.48 GW
2025 wind energy capacity	0.82 GW
2025 land disturbance (solar, statewide)	76,000 acres
2025 land requirement (wind, statewide)	23,000 acres (10% of which would be disturbed)
2025 land disturbance (solar, BLM lands)	12,000 acres
2025 land requirement (wind, BLM lands)	3,600 acres (10% of which would be disturbed)

GW = gigawatt; GWh = gigawatt-hour
1 GW = 1,000 MW

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Table 2-12
Summary of the Alternatives

No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
Goals: In accordance with existing BLM Arizona RMPs	Goals: • Ensure the most environmentally responsible development and delivery of renewable energy that contributes to protecting and enhancing Arizona's water, wildlife, and other natural resources. Help meet community energy needs, create economic opportunities, and provide good value to the taxpayer					
Objectives: In accordance with existing BLM Arizona RMPs	Objectives: • Identify disturbed sites, such as brownfields, landfills, abandoned mines, marginal or impaired agricultural lands, etc., which could be reused for renewable energy development; • Identify areas with low resource sensitivity and few environmental conflicts to lessen the risk for environmental conflicts; • Identify areas suitable for development that are adjacent to load centers; • Identify areas close enough to existing transmission to make it efficient and cost effective to bring the energy on-line; • Identify areas with enough acreage of public lands to help meet the renewable energy demand (including the Arizona RPS), and provide flexibility for micro-siting and mitigation; • Identify a SEZ specifically for utility-scale solar energy developments (more than 20 MW) in accordance with national BLM policy and guidance (BLM and DOE 2010, 2011; Solar PEIS) and • Engage cooperating agencies, tribes, and stakeholders in order to obtain broad consensus on the desired future renewable energy footprint in Arizona and to inform renewable energy developers in their siting of projects throughout the state.				Objectives: • Same as Alternatives 1 through 4, plus • Dispose of BLM lands within identified REDAs for non-federal lands within areas of high conservation priority	Objectives: • Same as Alternative 5
Allocation: SEZ – No existing decision in existing BLM Arizona RMPs	Allocation: Agua Caliente Solar Energy Zone, 20,600 acres	Allocation: Agua Caliente Solar Energy Zone, 6,770 acres	Allocation: Agua Caliente Solar Energy Zone, 2,760 acres	Allocation: Same as Alternative 1	Allocation: None	Allocation: Same as Alternative 2
Allocation: In accordance with existing BLM Arizona RMPs	Allocation: Maximize the area identified for renewable energy development with the fewest constraints. Includes RDEP-nominated sites, low resource sensitivity areas, and SEZs as identified in the Solar PEIS.	Allocation: Reduce environmental impacts by focusing renewable energy development on lands within reasonable proximity to designated utility corridors and existing or certified transmission lines. Includes the Maximum REDA lands narrowed further to only those lands within a 5-mile buffer around: (1) BLM-designated utility corridors; (2) existing transmission lines; and (3) reasonably foreseeable proposed transmission lines.	Allocation: Reduce disturbance and environmental impacts by keeping energy generation near the point of demand. Includes Maximum REDA lands within a 10-mile buffer around all towns, a 5-mile buffer of the U.S. Bureau of Reclamation Central Arizona Project area and center pivot irrigation systems, a 20-mile buffer around Palo Verde, and a 20-mile buffer around the town of Gila Bend.	Allocation: Avoid impacts on sensitive surface watersheds, protecting groundwater quality and quantity, reducing consumptive use of water, without causing environmental, economic, or social consequences. Includes Maximum REDA lands then applied Water Resource Protection Level criteria.	Allocation: Plan for environmentally sound renewable energy development in Arizona and flexibility for off-site conservation by focusing on lands which prior planning processes have identified for disposal due to their low value for public uses, have limited value for retention, and that do not have any known sensitive resources.	Allocation: A blending of four alternatives; incorporating transmission and load offset acreages (Alternatives 2 and 3) and applying the resource protections from Alternatives 3 and 5.

Table 2-12 *(continued)*
Summary of the Alternatives

No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
	Management Actions, Design Features, BMPs: • Listed under **Section 2.3.2**, Elements Common to All Alternatives		Management Actions, Design Features, BMPs: • Listed under **Section 2.3.2**, Elements Common to All Alternatives	Management Actions, Design Features, BMPs: • Listed under **Section 2.3.2**, Elements Common to All Alternatives • Limitations listed under each Water Resource Protection Level • Water Resource Mitigation and Monitoring Plan with the addition of water augmentation techniques	Management Actions, Design Features, BMPs: ▪ Listed under **Section 2.3.2**, Elements Common to All Alternatives • Additional review and consideration of priority resource criteria prior to disposal of land	Management Actions, Design Features, BMPs: • Same as Alternative 4, plus • Actions, Design Features, BMPs from Alternative 5

Table 2-13
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
Air Quality and Air Quality-related Values	Renewable energy actions would be processed on a case-by-case basis. Indirect impacts include construction- and operations-related emissions. Emissions would be dispersed across the planning area. Operational emissions would not contribute to regional degradation of air quality over the long term. Projects would be dispersed over the entire planning area. Standardized design features and BMPs would not be implemented under this alternative.	REDA: No direct impacts from identification of REDA. Indirect impacts include construction- and operations-related emissions. Emissions would be dispersed across the REDA. Emissions would not contribute to regional degradation of air quality over the long term. Projects would be dispersed over the widest area; temporary construction-related impacts could be greatest under this alternative. Design features and BMPs would be implemented to reduce air quality impacts.	REDA: Same as Alternative 1; however, as this alternative only includes lands within five miles of existing or certified transmission lines and utility corridors, the distance to connect any proposed developments would be minimized, potentially reducing construction-related impacts. Design features and BMPs would be implemented to reduce air quality impacts.	REDA: Same as Alternative 1; however, limiting development to within 10 miles of load centers could encourage development closer to populated areas, resulting in potential localized short-term air quality impacts on sensitive receptors. Development closer to population centers may reduce the miles of dirt access roads required, potentially reducing regional fugitive dust impacts. Design features and BMPs would be implemented to reduce air quality impacts.	REDA: Same as Alternative 1. With the additional water resource design features, this alternative may encourage PV solar technology over other forms of solar development, slightly reducing potential operation-related emissions. Design features and BMPs would be implemented to reduce air quality impacts.	REDA: Same as Alternative 1; however, this alternative may result in the least amount of development on BLM-administered lands. Design features and BMPs would be implemented to reduce air quality impacts.	REDA: Similar to Alternative 2 in that alternative would reduce construction-related impacts by placing REDA closer to transmission lines and utility corridors. Similar to Alternative 3 by encouraging development closer to population centers, resulting in potential short-term air quality impacts on sensitive receptors. Similar to Alternative 4 by slightly reducing potential operation-related emissions. Design features and BMPs would be implemented to reduce air quality impacts.
	N/A	Proposed SEZ: Similar to impacts under REDA. The size of the proposed SEZ has the potential to support the largest amount of utility-scale renewable energy development, resulting in localized fugitive dust generation and traffic-related exhaust emissions. Design features and BMPs would be implemented to reduce air quality impacts.	Proposed SEZ: Same as Alternative 1. With a smaller footprint, Alternative 2 would likely result in a lesser amount of development within the proposed SEZ; therefore, short-term impacts would be less. Design features and BMPs would be implemented to reduce air quality impacts.	Proposed SEZ: Same as Alternative 1. With the smallest footprint, Alternative 3 would likely result in a least amount of development within the proposed SEZ, resulting in the lowest emission levels. Design features and BMPs would be implemented to reduce air quality impacts.	Proposed SEZ: Same as described above for REDA above and Alternative 1. Design features and BMPs would be implemented to reduce air quality impacts.	N/A	Proposed SEZ: Same as Alternative 2 and Alternative 4. Design features and BMPs would be implemented to reduce air quality impacts.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
Greenhouse Gas Emissions and Climate Change	Renewable energy actions would be processed on a case-by-case basis. Primary sources of greenhouse gas (GHG) emissions are from clearing vegetation (releasing sequestered carbon), and emissions from heavy construction equipment and vehicles. Renewable energy facilities provide potential GHG savings in the form of offsetting energy produced by fossil fuel sources, resulting in a reduction of GHG emissions.	REDA: Same as the No Action Alternative; however, with the added goals, objectives, and management actions, there is a greater likelihood for a more substantial reduction in GHG emissions.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.
	N/A	Proposed SEZ: Same as the REDA, noted above.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.
Cultural Resources	Renewable energy actions would be processed on a case-by-case basis in accordance with existing land use planning decisions. Anticipated impacts include damage, destruction, discovery, and analysis of cultural resources. However, with the existing requirements for protection of eligible cultural and historic resources, any impact on resources would be avoided or mitigated.	REDA: Types of impacts would be similar to those described in the No Action Alternative. Using the predictive model, approximately 5,403 newly identified sites could occur within the Maximum REDA. It is unlikely that many known NRHP-eligible sites would be affected by development within the REDA. Implementation of the design features and BMPs would reduce the impacts.	REDA: Types of impacts would be similar to those described in the No Action Alternative. Using the predictive model, approximately 3,673 newly identified sites could occur within the REDA. It is unlikely that many known NRHP-eligible sites would be affected by development within the REDA. Implementation of the design features and BMPs would reduce the impacts.	REDA: Types of impacts would be similar to those described in the No Action Alternative. Using the predictive model, approximately 2,182 newly identified sites could occur within the REDA. It is unlikely that many known NRHP-eligible sites would be affected by development within the REDA. Implementation of the design features and BMPs would reduce the impacts.	REDA: Same as Alternative 1.	REDA: Types of impacts would be similar to those described in the No Action Alternative. Using the predictive model, approximately 734 newly identified sites could occur within the REDA. It is unlikely that many known NRHP-eligible sites would be affected by development within the REDA. Implementation of the design features and BMPs would reduce the impacts.	REDA: Types of impacts would be similar to those described in the No Action Alternative. Using the predictive model, approximately 3,985 newly identified sites could occur within the REDA. It is unlikely that many known NRHP-eligible sites would be affected by development within the REDA. Implementation of the design features and BMPs would reduce the impacts.
	N/A	Proposed SEZ: Construction activities have the potential to impact prehistoric resources and historic military-related	Proposed SEZ: The reduction in size of the SEZ would reduce the potential for impacts by eliminating the more-remote areas	Proposed SEZ: Same as Alternative 2; however, with the smaller footprint, any potential development would be closer to the	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 4.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		resources. Implementation of the design features and BMPs would reduce the impacts.	near mountains and major washes that could contain undisturbed archaeological sites. Implementation of the design features and BMPs would reduce the impacts..	White Wing Ranch.			
Energy and Minerals	Renewable energy would be permitted on a case-by-case basis. If renewable energy facilities were constructed, future leasable mineral activities would be precluded, unless the leasable mineral was accessible via directional drilling technologies. Valid mining claims would preclude solar or wind energy development. If solar or wind developments occur in areas of high locatable mineral potential, there would be impacts on exploration and development. Solar or wind developments would preclude future mining activities for salable mineral materials, but would be negligible due to an abundance of material throughout the planning area.	REDA: Impacts on oil, gas, and geothermal resources are anticipated to be negligible due to few resources being present in the REDA and the fact that they could be accessed with directional drilling methods. Metallic mineral districts and areas with high potential of known mineral deposits have been eliminated from the REDA, thereby reducing impacts on these resources from renewable energy developments. Prior to authorizing new energy developments, BLM would identify existing valid mining claims within the project area and determine if it is possible to locate the facility in or close to these areas in such a way as to avoid future adverse effects on mineral development activities. Future saleable mining activities would be precluded in areas with solar and wind energy	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		facility development within the REDA. However, there are numerous available locations in the planning area, so dispersed impacts on salable mineral development would be negligible.					
	N/A	Proposed SEZ: Impacts on leasable, salable, and locatable minerals are expected to be negligible.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.
Environmental Justice	Renewable energy developments would be permitted on a case-by-case basis. Impacts on environmental justice populations would be assessed on a project-specific basis.	REDA: As the REDA excludes tribal lands, there would be negligible impacts on Native American populations. Should developments occur in Santa Cruz or Yuma Counties, impacts on environmental justice populations may occur.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.
	N/A	Proposed SEZ: Impacts on environmental justice populations within Yuma County may occur.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.
Fish and Wildlife	Renewable energy actions would occur on a case-by-case basis and would be assessed based on land use planning decisions. Renewable energy actions would likely result in patchy, fragmented development with an increased likelihood of habitat disturbance and fragmentation of wildlife habitat.	REDA: There would be no direct impacts from identifying a REDA. Indirect impacts would result from implementing the planning decisions and possible future ground-disturbing activities associated with renewable energy developments. By screening out sensitive wildlife areas from consideration, the impacts	REDA: Similar to Alternative 1, except that there would be 96,800 acres in Conservation Potential Category 1, 90,400 acres in Conservation Potential Category 2, and 21,100 acres in Conservation Potential Category 3.	REDA: Similar to Alternative 1, except that there would be 79,900 acres in Conservation Potential Category 1, 18,700 acres in Conservation Potential Category 2, and 15,800 acres in Conservation Potential Category 3.	REDA: Same as Alternative 1.	REDA: Similar to Alternative 1, except that there would be 16,800 acres in Conservation Potential Category 1, 11,200 acres in Conservation Potential Category 2, and 2,200 acres in Conservation Potential Category 3.	REDA: Similar to Alternative 1, except that there would be 103,300 acres in Conservation Potential Category 1, 90,500 acres in Conservation Potential Category 2, and 27,300 acres in Conservation Potential Category 3.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		would be reduced compared to the No Action Alternative. Development within the REDA would reduce disturbance on lands with high wildlife value and encourage development on previously disturbed lands, reducing habitat fragmentation. Implementation of the design features and BMPs would further reduce the likelihood for impacts. There would be 121,400 acres in Conservation Potential Category 1, 106,700 acres in Conservation Potential Category 2, and 84,100 acres in Conservation Potential Category 3.					
	N/A	Proposed SEZ: Development would remove and fragment wildlife habitat in the southern portion of the Palomas Plain Wildlife Habitat Area (WHA), resulting in habitat loss and fragmentation. Implementation of the design features would likely reduce these impacts. There would be 19,690 acres in Conservation Potential Category 1, 10 acres in Conservation	Proposed SEZ: Similar to Alternative 1, except that with the smaller footprint, less area in the Palomas Plain WHA would be impacted. There would be 6,560 acres in Conservation Potential Category 1, 50 acres in Conservation Potential Category 3, 140 acres in Conservation Potential Category 4, and 10 acres in Conservation Potential Category 5.	Proposed SEZ: Similar to Alternative 1, except that with the smallest footprint, the least area in the Palomas Plain WHA would be impacted. There would be 2,600 acres in Conservation Potential Category 1, 50 acres in Conservation Potential Category 3, and 110 acres in Conservation Potential Category 4.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 2.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		Potential Category 2, 190 acres in Conservation Potential Category 3, 690 acres in Conservation Potential Category 4, and 20 acres in Conservation Potential Category 5.					
Geology and Seismicity	As most land use plans require consideration or protection of unique geologic resources, there would be negligible impacts as a result of renewable energy developments. If a land use plan did not allow for protection of unique geological resources, there would be a greater risk of construction-related impacts. Indirect impacts would likely result from visual, aural, and atmospheric intrusions into a pristine landscape if developments were to occur close to unique geological resources.	REDA: Impacts would be similar to those described in the No Action Alternative; however, with implementation of the required design features and BMPs, the impacts would be reduced.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.
	N/A	Proposed SEZ: There would be negligible impacts.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.
Land Use and Realty	Renewable energy actions would be permitted on a case-by-case basis in conformance with current land use plans. Development could result in fragmented and segregated land uses and access. Developments could occur in areas with high resource sensitivity.	REDA: Full development of the REDA under Alternative 1 is assumed to involve solar production on 80 percent of the 321,500 acres; at a rate of 8 acres per megawatt, development of the 257,200 acres would result in an estimated electrical capacity of 32.2 GW.	REDA: Similar to Alternative 1, except that is assumed to involve solar production on 80 percent of the 218,600 acres; at a rate of 8 acres per megawatt, development of the 174,880 acres would result in an estimated electrical capacity of 21.9 GW.	REDA: Similar to Alternative 1, except it is assumed to involve solar production on 80 percent of the 129,800 acres; at a rate of 8 acres per megawatt, development of the 103,840 acres would result in an estimated electrical capacity of 13 GW.	REDA: Same as Alternative 1.	REDA: Similar to Alternative 1, except it is assumed to involve solar production on 80 percent of the 43,700 acres; at a rate of 8 acres per megawatt, development of the 34,960 acres would result in an estimated electrical capacity of 4.4 GW.	REDA: Similar to Alternative 1, except it is assumed to involve solar production on 80 percent of the 237,100 acres; at a rate of 8 acres per megawatt, development of the 189,680 acres would result in an estimated electrical capacity of 23.7 GW.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		Alternative 1 is assumed to involve wind development on 10 percent of lands identified as Class 2 (43,300 acres) and Class 3 (1,400 acres); at a rate of 28 acres per megawatt, development of the 4,700 acres would result in an estimated electrical capacity of 1.6 GW. Depending upon where development occurred within the REDA, access into BLM-administered lands may be altered. The large REDA would provide opportunities to minimize conflicts with public access. It is anticipated that implementing required design features and BMPs would reduce impacts on public uses and access.	Similar to Alternative 1, except that it is assumed to involve wind development on 10 percent of lands identified as Class 2 (28,000 acres); at a rate of 28 acres per megawatt, development of the 2,800 acres would result in an estimated electrical capacity of 1 GW. As this alternative keeps development closer to transmission lines, additional impacts from siting and construction of new lines would be reduced.	Similar to Alternative 1, except that it is assumed to involve wind development on 10 percent of lands identified as Class 2 (2,300 acres); at a rate of 28 acres per megawatt, development of the 230 acres would result in an estimated electrical capacity of 82 MW. As this alternative keeps development closer to load centers, development would be more consistent with surrounding land uses.		Similar to Alternative 1, except that it is assumed to involve wind development on 10 percent of lands identified as Class 2 (4,100 acres); at a rate of 28 acres per megawatt, development of the 410 acres would result in an estimated electrical capacity of 146 MW. Due to the small amount of REDA acreage in this alternative, there would be less flexibility in siting renewable energy facilities and infrastructure, possibly resulting in more land use and access conflicts.	Similar to Alternative 1, except that it is assumed to involve wind development on 10 percent of lands identified as Class 2 (28,100 acres); at a rate of 28 acres per megawatt, development of the 2,810 acres would result in an estimated electrical capacity of 1 GW. As the alternative keeps development closer to load centers and transmission lines, development would be more consistent with surrounding land uses, and additional impacts from siting and construction of new lines would be reduced.
	N/A	Proposed SEZ: If the proposed SEZ were fully developed, there would be conflicts with existing recreational uses of the area; however, if development were concentrated around existing facilities, impacts would be reduced. Existing access may be altered based on the scale and location of development.	Proposed SEZ: Similar to Alternative 1, except that with the smaller footprint there would be less impacts on recreational uses, and necessary transmission connections and access roads would be less due to the boundary of the proposed SEZ being closer to the existing infrastructure.	Proposed SEZ: Similar to Alternative 1, except that with the smallest footprint there would be the fewest impacts on recreational uses, and necessary transmission connections and access roads would be less due to the boundary of the proposed SEZ being closer to the existing infrastructure.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 2.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		Implementation of the design features and BMPs would reduce impacts by identifying conflicts early in the process and requiring specific measures to maintain public uses and access.					
Livestock Grazing	Renewable energy actions would be permitted on a case-by-case basis in conformance with current land use plan decisions. Project siting would likely result in patchy, fragmented developments across the landscape. Impacts on grazing would be assessed on a project-specific level. Developments would possibly occur in areas with high resource sensitivity.	REDA: The entire REDA has allotted grazing lands, resulting in some decrease in grazing production due to areas being developed for renewable energy facilities. Large-scale solar facilities are an incompatible use with grazing due to the large amounts of acreage that would be taken out of production, resulting in areas becoming unavailable for grazing. Wind development would take fewer acres out of production and would generally be considered a compatible use.	REDA: Same as Alternative 1, except that the REDA has fewer acres; therefore, less area would be taken out of production.	REDA: Same as Alternative 2.	REDA: Same as Alternative 2.	REDA: Same as Alternative 1, except that with this alternative having the least amount of acreage, development would result in the least area being taken out of production.	REDA: Same as Alternative 1.
	N/A	Proposed SEZ: The proposed SEZ is in the Palomas allotment, which has had no grazing in the recent past; therefore, impacts would be negligible.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.
National Trails	The case-specific studies that would address impacts on National Trails required prior to any issuance of a ROW for renewable energy development would likely prevent many impacts	REDA: Approximately 22,000 acres of BLM-administered land within the REDA occur within 5.25 miles of the three National Trails in the planning area. Application	REDA: Approximately 17,500 acres of BLM-administered land within the REDA occur within 5.25 miles of the three National Trails in the planning area. Application	REDA: Approximately 17,800 acres of BLM-administered land within the REDA occur within 5.25 miles of the three National Trails in the planning area. Application	REDA: Same as Alternative 1.	REDA: Approximately 4,700 acres of BLM-administered land within the REDA occur within 5.25 miles of the three National Trails in the planning area. Application	REDA: Approximately 21,800 acres of BLM-administered land within the REDA occur within 5.25 miles of the three National Trails in the planning area. Application

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
	on national scenic and historic trails. However, there would be no comprehensive list of design features or BMPs that would serve as consistent guidance for future renewable energy development, resulting in fragmented and segregated developments.	of the proposed design features and BMPs would reduce impacts on the national and scenic trails, including restricting disturbance within the viewshed of trail segments potentially eligible for listing on the NRHP.	of the proposed design features and BMPs would reduce impacts on the national and scenic trails, including restricting disturbance within the viewshed of trail segments potentially eligible for listing on the NRHP.	of the proposed design features and BMPs would reduce impacts on the national and scenic trails, including restricting disturbance within the viewshed of trail segments potentially eligible for listing on the NRHP.		of the proposed design features and BMPs would reduce impacts on the national and scenic trails, including restricting disturbance within the viewshed of trail segments potentially eligible for listing on the NRHP.	of the proposed design features and BMPs would reduce impacts on the national and scenic trails, including restricting disturbance within the viewshed of trail segments potentially eligible for listing on the NRHP.
	N/A	Proposed SEZ: Depending on the type of technology used, the viewshed of the Juan Bautista de Anza National Historic Trail may be impacted from development within the proposed SEZ (e.g., a PV array would be less intrusive than a CSP tower).	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.
Native American Interests and Heritage Resources	Impacts include direct disturbance of locations associated with traditional beliefs, resource gathering or hunting areas, water sources, ancestral sites, human remains, and trails. Other impacts could result from alternations of visual, aural, and atmospheric aspects of the setting of a place of traditional religious or cultural importance. Compliance with existing laws would reduce these impacts.	REDA: Types of impacts would be similar to those described in the No Action Alternative; however, with the addition of the proposed design features and BMPs, impacts would be reduced or avoided. There may be residual effects, such as permanent loss of some cultural uses or valued qualities of places within traditional tribal territories as a result of renewable energy development.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Similar to Alternative 1, except that with the additional water design features, there would likely be a reduction in impacts on water resources that Native American tribes consider sacred or culturally important.	REDA: Similar to Alternative 1, except that due to the REDA's small size, if heritage resources were discovered within the REDA, it would be more difficult to move or microsite any proposed development.	REDA: Same as Alternative 4.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
	N/A	Proposed SEZ: The proposed SEZ is within 10 miles of the Sears Point ACEC, a significant Native American heritage site. There may be visual, aural, or atmospheric intrusions on the landscape as a result of development within the SEZ. In addition to the required design features and BMPs that would reduce impacts, continuing consultation with tribes may provide additional mitigations that would further reduce impacts on this area.	Proposed SEZ: Similar to Alternative 1; however, the smaller size of the proposed SEZ would likely eliminate portions of the cultural resources known to occur within the area. Implementation of the design features and BMPs, and continued consultation with tribes would reduce impacts.	Proposed SEZ: Similar to Alternative 1; however, considering that the proposed SEZ is the smallest area proposed, it would eliminate more of the known cultural resources, thereby further reducing impacts. However, if heritage resources were discovered within the area, it would be more difficult to move or microsite any proposed development.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 2.
Noise	Projects would have short-term and localized noise impacts at the project sites, along area roadways, and along new transmission or generation tie-in routes during construction. No standard list of design features or BMPs would be in place to reduce noise impacts, although permitting for individual projects would require analysis and mitigation of impacts.	REDA: Similar to types of impacts anticipated under the No Action Alternative. This alternative has the most flexibility for siting projects due to its large acreage area. Design features and BMPs would require that individual projects avoid or mitigate noise impacts on sensitive land uses or within sensitive receptor areas.	REDA: Similar to Alternative 1, except that the distance to connect any proposed development to transmission would be minimized, reducing construction-related noise impacts associated with transmission lines.	REDA: Similar to Alternative 1; however, as this alternative encourages development close to load centers and populated areas, there is the potential for short-term noise impacts on sensitive receptors if these receptors were located adjacent to construction activity areas. Design features and BMPs would require that individual projects avoid or mitigate noise impacts on sensitive receptors, thereby reducing impacts.	REDA: Similar to Alternative 1; however, the additional water design features would likely prevent wet cooling technologies, which would encourage PV solar and thus slightly reduce potential operation-related noise emissions.	REDA: Same as Alternative 1.	REDA: Similar to Alternative 2 in area, similar to Alternative 3 in the potential effects on sensitive receptors, and similar to Alternative 4 in prohibiting wet cooling technologies. Design features and BMPs would require that individual projects avoid or mitigate noise impacts within sensitive receptor areas.
	N/A	Proposed SEZ: Given the lack of sensitive receptors in the area around the proposed SEZ, impacts are	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		anticipated to be minimal. Application of the required design features and BMPs would further reduce impacts.					
Paleontological Resources	Impacts could include destruction of the resource and loss of valuable scientific information, degradation of near-surface paleontological resources and their stratigraphic context, and human disturbance of near-surface paleontological resources. Mitigation measures would be included on a case-by-case basis.	REDA: Types of impacts would be the same as described under the No Action Alternative. There are 137,900 acres of BLM-administered land assigned to Potential Fossil Yield Classification (PFYC) levels 3, 4, or 5 (Moderate/ Undetermined to High Sensitivity). Implementation of the design features and BMPs would reduce the likelihood and severity of impacts.	REDA: Similar to Alternative 1, except that there are 58,400 acres of BLM-administered land assigned to PFYC levels 3, 4, or 5 (Moderate/ Undetermined to High Sensitivity). Implementation of the design features and BMPs would reduce the likelihood and severity of impacts.	REDA: Similar to Alternative 1, except that there are 41,300 acres of BLM-administered land assigned to PFYC levels 3, 4, or 5 (Moderate/ Undetermined to High Sensitivity). Implementation of the design features and BMPs would reduce the likelihood and severity of impacts.	REDA: Same as Alternative 1.	REDA: Similar to Alternative 1, except that there are 7,900 acres of BLM-administered land assigned to PFYC levels 3, 4, or 5 (Moderate/ Undetermined to High Sensitivity). Implementation of the design features and BMPs would reduce the likelihood and severity of impacts.	REDA: Similar to Alternative 1, except that there are 61,500 acres of BLM-administered land assigned to PFYC levels 3, 4, or 5 (Moderate/ Undetermined to High Sensitivity). Implementation of the design features and BMPs would reduce the likelihood and severity of impacts.
	N/A	Proposed SEZ: Impacts would be the same as the types described in the No Action Alternative. There are 4,070 acres assigned to PFYC level 3; there are no PFYC level 4 or 5 units. Impacts on potential paleontological deposits would be reduced with the application of the required design features and BMPs.	Proposed SEZ: Same as Alternative 1, except that there are 490 acres assigned to PFYC level 3 and no PFYC level 4 or 5 units.	Proposed SEZ: Same as Alternative 1, except that there are 10 acres assigned to PFYC level 3 and no PFYC level 4 or 5 units.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 2.
Public Health and Safety	Impacts under the No Action Alternative are expected to be negligible.	REDA: Development of previously disturbed lands that may contain varying levels of contamination may result in the cleanup and securing of these lands, thereby reducing sources of hazardous substances.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		Implementation of design features and BMPs would likely reduce impacts to negligible levels.					
	N/A	Proposed SEZ: Unexploded ordnance could pose a risk of explosion during ground-disturbing operations. Implementation of design features and BMPs would reduce impacts to negligible levels.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.
Recreation	Direct impacts would result from fencing solar energy facilities, resulting in the exclusion of the public from areas that once were available for recreational purposes. Wind energy facilities are not usually fenced and may allow limited on-site recreation. Indirect impacts include degradation of the recreation setting characteristics and increased access from the construction of new or improved roads that may be integrated with local trail and road systems.	REDA: There would be greater potential for conflict with recreational opportunities and experiences. Impacts would be mitigated through avoidance of areas with unique or important recreation resources. OHV enthusiasts could potentially retain access to the same number of miles of trails and roads due to integration with new or improved roads from construction.	REDA: Because the REDA would be in close proximity to transmission lines and utility corridors, development would be concentrated in a smaller area, resulting in development becoming more concentrated and impacts on nearby recreation resources becoming more amplified.	REDA: Impact types would be similar to the No Action Alternative; however, by concentrating in areas close to towns, cities, and other load centers, impacts on developed recreation would be more likely than on dispersed recreation.	REDA: Same as Alternative 1.	REDA: Impacts under this alternative would be negligible as the REDA is located on disposal lands not highly valued for recreational resources.	REDA: Impacts would be similar to those described in the No Action Alternative, Alternative 2, and Alternative 3.
	N/A	Proposed SEZ: Locating utility-scale renewable energy developments within the proposed SEZ would result in long-term loss of recreational opportunities and experiences within the Yuma undeveloped special recreation management	Proposed SEZ: Impacts would be similar to Alternative 1; however, as the proposed SEZ is smaller, development would be more concentrated, resulting in fewer conflicts with recreation in the SRMA.	Proposed SEZ: Impacts would be similar to Alternative 1, except that popular hunting areas in the northern area above the proposed SEZ would be preserved, and recreational opportunities and experiences would be	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 2.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		area (SRMA).		retained.			
Socioeconomics	There could be increased unanticipated impacts from the lack of planning for appropriate land uses, which could alter the character of rural areas and increase the potential for social or economic impacts on local communities.	REDA: The majority of development would not be located adjacent to large population centers. Impacts on local communities during construction could occur should a large number of workers be required to temporarily move to the area, possibly resulting in a strain on housing and service resources. Jobs and related income, tax revenue, and social changes in local communities would differ depending on the location of potential development. With the inclusion of previously disturbed lands and areas with low resource sensitivity, more high-value lands would be available for community use and ecosystem services.	REDA: Similar to Alternative 1.	REDA: Similar to Alternative 1; however, impacts would be concentrated near towns, cities, and other load centers, resulting in a higher likelihood for workers to be drawn from the local employment pool.	REDA: Same as Alternative 1.	REDA: Similar to Alternative 1, except that the REDA is considerably smaller, resulting in less potential for employment opportunities, and related impacts on local and regional economies and social structure.	REDA: Similar to those described in Alternative 1 and Alternative 3.
	N/A	Proposed SEZ: Minimal social and economic impacts immediately surrounding the proposed SEZ. Development would likely require 18 to 40 temporary construction jobs and 2 to 14 permanent operations/maintenance jobs. Workers would likely be drawn from the local region and a large population increase would not be anticipated.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
Soil Resources	Impacts could include soil compaction, disruption of biological crusts or desert pavement, and changes in soil erosion or deposition. Erosion could result in decreased soil productivity by carrying away nutrients normally stored in the upper soil horizon. Given the low precipitation and limited vegetation levels in the planning area, soil productivity would be slow to recover. No standard set of design features or BMPs would be available.	REDA: Impacts would be similar to those described in the No Action Alternative, except that the REDA is dominated by Aridisols, which located with sparse vegetative cover and low organic content are susceptible to erosion. However, with the implementation of the required design features and BMPs, impacts would be reduced.	REDA: Same as Alternative 1, except there would be less acreage of Aridisols due to the REDA's smaller overall size.	REDA: Same as Alternative 1, except there would be less acreage of Aridisols due to the REDA's smaller overall size.	REDA: Same as Alternative 1, except there would be less acreage of Aridisols due to the REDA's smaller overall size.	REDA: Same as Alternative 1.	REDA: Same as Alternative 1 and Alternative 4.
	N/A	Proposed SEZ: Soil resources in the proposed SEZ have low to moderate susceptibility to erosion. Site design features and BMPs would limit the potential for impacts on soil resources.	Proposed SEZ: Same as Alternative 1 except that the size of the SEZ is reduced so the scale of impacts would be less.	Proposed SEZ: Same as Alternative 1 except that the size of the SEZ is reduced so the scale of impacts would be less.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1 except that the size of the SEZ is reduced so the scale of impacts would be less.
Special Designations	Impacts on congressional designations would be negligible. In administrative designations, where wind and solar energy development is not specifically precluded, field offices would determine if wind and solar energy development would be in conformance with the prescriptions outlined in the relevant land use plan(s).	REDA: Areas with special designations have been eliminated from consideration as a REDA; therefore, direct impacts from potential development in these areas would be negligible. Within five miles of BLM-administered lands within the REDA, there are 19 ACECs, 2 backcountry byways, 2 national conservation areas, 5 national monuments, 5	REDA: Similar to Alternative 1, except that there are 18 ACECs, 2 backcountry byways, 2 national conservation areas, 4 national monuments, 2 national parks, 25 wilderness areas, and 1 WSA within 5 miles of BLM-administered land within the REDA.	REDA: Similar to Alternative 1, except that within 5 miles of BLM-administered lands within the REDA, there are 13 ACECs, 1 backcountry byway, 2 national conservation areas, 4 national monuments, 4 national parks, 19 wilderness areas, and 1 WSA.	REDA: Same as Alternative 1.	REDA: Similar to Alternative 1, except that within 5 miles of BLM-administered lands within the REDA, there are 8 ACECs, 2 national conservation areas, 4 national monuments, 4 national parks, 14 wilderness areas, and 1 WSA.	REDA: Similar to Alternative 1, except that within 5 miles of BLM-administered lands within the REDA, there are there are 18 ACECs, 2 backcountry byways, 2 national conservation areas, 4 national monuments, 4 national parks, 25 wilderness areas, and 1 WSA.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		national parks, 28 wilderness areas, and 1 Wilderness Study Area (WSA). Solar and wind energy development within the REDA could impact these areas by affecting scenic, cultural, or fish and wildlife resources.					
	N/A	Proposed SEZ: There are no special designations within the proposed SEZ. The Sears Point ACEC may be impacted by solar energy development in the proposed SEZ, as certain types of development would be visible from the ACEC.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.
Special Status Species	Impacts on special status species would be assessed on a project-specific level, and measures to avoid important habitat and mitigate impacts would be undertaken. In the absence of identifying the REDA, however, solar and wind project development would likely result in patchy, fragmented development with an increased likelihood of habitat disturbance and fragmentation for special status species. In addition, no standard set of design features or BMPs would be developed for protection of special status species.	REDA: The REDA has been designed to minimize impacts on special status species by directing future development to areas where current habitat values are poor or fragmented and potential for special status species occupation is limited, resulting in reduced impacts. While the limited potential for special status species to be injured, killed, or disturbed due to project construction or operations remains, impacts would be minimal due to the exclusion of important	REDA: Similar to Alternative 1. Locating energy development near existing transmission lines and utility corridors would indirectly protect special status species habitat from removal and fragmentation by reducing the need for new habitat disturbance associated with ROW development.	REDA: Same as Alternative 1.	REDA: Similar to Alternative 1. The focus on protection of the groundwater supply in Alternative 4 would benefit special status species by maintaining water available to vegetation, which would therefore maintain wildlife habitats.	REDA: Similar to Alternative 1. Development on lands identified for disposal in existing RMPs would reduce impacts on special status species, as these lands would not have special status species populations or habitats.	REDA: Similar to Alternatives 1, 2, and 3. By combining the protective features of all the alternatives, this alternative would maximize avoidance of special status species habitats and would reduce habitat disturbance and fragmentation.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		habitat areas and the existing uses of the REDA, which are disturbed sites and do not provide suitable special status species habitat. Application of the required design features and BMPs would further reduce impacts on special status species.					
	N/A	Proposed SEZ: No special status species have been recorded within the proposed SEZ; therefore, impacts are anticipated to be minimal. Habitat for several special status species is located within the proposed SEZ. Design features and best management practices would protect habitat from removal associated with solar energy development. Other design features would minimize disturbance caused by construction noise and disruptions during the breeding seasons. These design features would reduce the likelihood for impacts on special status species.	Proposed SEZ: Similar to Alternative 1; however, the reduced size eliminates several washes with special status species habitat. As such, there would be fewer impacts on those special status species that rely on riparian and desert wash habitats.	Proposed SEZ: Similar to Alternative 1; however, the reduced size avoids all major washes. As such, there would be fewer impacts on those special status species that rely on riparian and desert wash habitats.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 2.
Travel Management	Impacts include increased traffic during construction, and reducing, eliminating, or adding access on routes.	REDA: Impacts would be similar to those described in the No Action Alternative. More area	REDA: Impacts would be similar to those described in the No Action Alternative. However, by	REDA: Locating the REDA near cities, towns, and other load centers would likely result in development	REDA: Same as Alternative 1.	REDA: Under Alternative 5, the REDA would be composed of land identified for disposal in existing	REDA: Same as Alternatives 1, 2, and 3.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
	Field offices would determine if wind and solar energy development would be in conformance with the travel management decisions in the relevant land use plan(s), but there would not be any guaranteed protection for travel management.	would be available to renewable energy development, resulting in a greater potential for conflict with travel management. However, by implementing the required design features and BMPs, impacts would be negligible.	focusing on utility corridors and areas near transmission lines, which often provide access, development in these areas may conflict with access. Impacts would be mitigated through the use of design features and BMPs.	in areas where roads and trails receive higher use, thereby increasing impacts. Impacts would be most prominent during construction, when more vehicles are needed for transporting equipment and personnel. Design features and BMPs would reduce but not eliminate impacts.		RMPs, which would not include areas highly valued for their access to adjacent lands. As a result, impacts on travel management would be negligible.	
	N/A	Proposed SEZ: Impacts on motorized travel are expected to be negligible as routes in the proposed SEZ are classified as digital linear features or nonmotorized routes and usage is documented as light. Although some routes within the proposed SEZ are classified as nonmotorized routes, impacts on nonmotorized travel are expected to be minor because the routes receive light use.	Proposed SEZ: Similar to Alternative 1.	Proposed SEZ: Similar to Alternative 1.	Proposed SEZ: Similar to Alternative 1.	N/A	Proposed SEZ: Similar to Alternative 1.
Vegetation	The greatest impacts on vegetation are likely to occur during construction, as this phase has the greatest amount of surface-disturbing activities. Vegetation removal would also leave barren areas that would be susceptible to the introduction or spread of noxious weeds and invasive plant species. Other impacts include changes to	REDA: Impacts would be similar to those described in the No Action Alternative. The Sonoran Basin and Range and Mojave Basin and Range are the ecoregions that would be most likely to be affected on BLM-administered lands under Alternative 1. Implementation of the required design features and BMPs would reduce	REDA: Similar to Alternative 1, except that by locating energy development near existing transmission lines and utility corridors, this would reduce the need for vegetation removal associated with new ROW development, thereby indirectly protecting intact vegetation communities.	REDA: Same as Alternative 1. However, as the REDA is a smaller area, the impacts would occur on fewer acres.	REDA: Same as Alterative 1, except that the focus on protection of water resources would maintain water available to vegetation, which would thereby maintain the composition and structure of vegetation communities.	REDA: Same as Alternative 1. However, as the REDA has the smallest area, the impacts would occur on the fewest acres.	REDA: Similar to Alternative 1, except that Alternative 6 reduces impacts on vegetation by combining the protective features of the other action alternatives. This would reduce new vegetation disturbance and removal.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
	plant community composition, plant productivity, and plant health. Without a programmatic approach to solar and wind development, planning for vegetation may be fragmented and segregated, increasing impacts.	impacts on vegetation.					
	N/A	Proposed SEZ: Sonora-Mojave Creosotebush-White Bursage Desert Scrub is the community that would be most likely to be affected in the SEZ. Implementation of the required design features and BMPs would reduce impacts on vegetation.	Proposed SEZ: Same as Alternative 1. However, as the proposed SEZ is smaller, the disturbance could occur over a smaller area.	Proposed SEZ: Same as Alternative 2.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 2.
Visual Resources	Solar and wind energy development would continue to be authorized on a case-by-case basis. In areas identified as ROW exclusions, solar and wind energy development would not be permitted, thereby protecting the surrounding viewshed. In ROW avoidance areas, solar and wind energy development may be permitted if better locations cannot be found. Under such circumstances, development would still be required to meet the applicable VRM class assigned to the land on which the project would be	REDA: VRM Class I, II, and III lands have been eliminated from consideration as a REDA. There are exceptions, though, where pre-disturbed lands (nominated sites) happen to be located within VRM Class II and III areas. There are 8 nominated sites within VRM Class II that would cover 1,650 acres (less than 1 percent of the total VRM II acreage), and 21 nominated sites within VRM Class III that would cover 20,850 acres (less than 1 percent of the total VRM Class III acreage).	REDA: Similar to Alternative 1. Approximately 13,500 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA. **Table 4-23**, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 2, shows the number of sensitive receptors and associated acreages within five miles of the REDA.	REDA: Same as Alternative 1. **Table 4-24**, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 3, shows the number of sensitive receptors and associated acreages within five miles of the REDA.	REDA: Same as Alternative 1. However, because more restrictions would be imposed to protect water resources under Alternative 4, development is more likely to be in the form of PV versus CSP, particularly in Zone 3 areas, due to the amount of water required for CSP technology. PV development would generally be less visually obtrusive than CSP development, resulting in less of a visual impact.	REDA: Similar to Alternative 1. Approximately 200 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap the REDA**. Table 4-25**, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 5, shows the number of sensitive receptors and associated acreages within five miles of the REDA.	REDA: Similar to Alternative 1. Approximately 25,900 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA. **Table 4-26**, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 6 shows the number of sensitive receptors and associated acreages within five miles of the REDA.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
	developed.	Approximately 35,600 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap the REDA. Indirect impacts on visual resources would occur if solar or wind energy was developed within the viewshed of these VRM class areas, as such activities would result in a modification of the landscape and may be visible from the adjoining VRM Class I, II or III area. **Table 4-21**, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternatives 1 and 4 shows the number of sensitive receptors and associated acreages within five miles of the REDA.					
	N/A	Proposed SEZ: The Yuma Field Office RMP would be amended so that the proposed Agua Caliente SEZ would be managed as VRM Class IV instead of VRM Class III. This would result in a 21,030-acre reduction in VRM Class III areas while increasing VRM Class IV areas by the same amount. Due to existing	Proposed SEZ: Same as Alternative 1; however, 6,770 acres would be managed as VRM Class IV instead of VRM Class III.	Proposed SEZ: Same as Alternative 1; however, 2,760 acres would be managed as VRM Class IV instead of VRM Class III.	Proposed SEZ: Similar to Alternative 1. However, because the proposed SEZ is within the Zone 2 area, more restrictions would be imposed to protect water resources under Alternative 4. As such, development is more likely to be in the form of PV versus CSP technology due to the amount of water	N/A	Proposed SEZ: Same as Alternatives 2 and 4.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		and new landscape modifications within the proposed SEZ, it is unknown whether additional solar development would result in changes in the visual quality or sensitivity of the area to an extent that the VRI would change from Class III to Class IV.			required for CSP technology. PV development would generally be less visually obtrusive than CSP technology, resulting in less of a visual impact.		
Water Resources	Renewable energy applications would continue to be processed on a case-by-case basis and would not include design features and BMPs noted in the action alternatives. Without the REDA and the proposed SEZ being identified, applications are likely to occur on areas with sensitive water resources, and impacts are likely to occur on surface and groundwater resources. The grading of renewable energy project sites could impact surface water quality and quantity. Water needs for cooling are a function of the energy technology and size of the energy development site. Potential impacts on water quality would result from spills of hazardous liquids (e.g., oils and lubricants) and other industrial activities.	REDA: Alternative 1 eliminated surface waters, wetlands, streams, and floodplains from consideration as REDA. As a result, this alternative would have negligible impacts on surface water resources. Any proposed groundwater-supply extraction wells would be subject to review and approval by the ADWR. Design features and BMPs listed in **Appendix B** would establish the minimum specifications for management of individual renewable energy projects and mitigate adverse impacts on water resources. Under this alternative, there are 29,600 acres in Active Management Areas	REDA: Similar to Alterative 1. Under this alternative, there are 29,600 acres in AMAs and 6,100 acres in BLM Priority Watersheds.	REDA: Similar to Alterative 1. Under this alternative, there are 28,700 acres in AMAs and 3,800 acres in BLM Priority Watersheds.	REDA: Same as Alternative 1. However, Alternative 4 includes additional water resource protection design features that identify additional protections in Water Resource Protection Zones 2 and 3. Under this alternative, there are 29,600 acres in AMAs and 33,900 acres in BLM Priority Watersheds.	REDA: Similar to Alterative 1. Under this alternative, there are 2,300 acres in AMAs and 100 acres in BLM Priority Watersheds.	REDA: Similar to Alternatives 1 and 4. Under this alternative, there are 29,600 acres in AMAs and 6,200 acres in BLM Priority Watersheds.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		(AMAs) and 34,000 acres in BLM Priority Watersheds.					
	N/A	Proposed SEZ: The 20,600-acre SEZ contains approximately 300 acres of ephemeral washes. Water resources in the proposed SEZ would be impacted by construction, operations, and reclamation activities. Implementing the management actions, design features, and BMPs would effectively avoid or reduce impacts on water resources within the proposed SEZ, but would not provide specific measures to protect the highly vulnerable water resource found in the proposed SEZ.	Proposed SEZ: Same as Alternative 1, except that there are 30 acres of ephemeral washes in the 6,770-acre SEZ.	Proposed SEZ: Same as Alternative 1, except that there are 20 acres of ephemeral washes in the 2,760-acre SEZ.	Proposed SEZ: Impacts would be similar to Alternative 1. Implementing the management actions, design features, BMPs, and the additional water resource design features for Water Protection Zone 2 in the proposed SEZ would reduce impacts on water resources.	N/A	Proposed SEZ: Same as Alternatives 2 and 4.
Wild Horses	Impacts on wild horses and burros would be assessed on a project-specific level. Solar and wind project development would likely result in patchy, fragmented development with an increased likelihood of fragmentation of wild horse or burro ranges. In addition, no standard set of design features or BMPs would be developed for protection of wild horses and burros.	REDA: All herd management areas (HMAs) have been eliminated from the REDA; therefore, impacts on wild horse and burros would be negligible. There is limited potential for impacts to occur should development occur in a REDA adjacent to a HMA. Under Alternative 1, approximately 64,400 acres of HMAs on BLM-administered lands are within five miles of the REDA. In particular, actions that reduced available water in the surrounding	REDA: Similar to Alternative 1. Under this alternative, approximately 43,400 acres of HMAs on BLM-administered lands are within five miles of the REDA.	REDA: Similar to Alternative 1. Under this alternative, approximately 43,400 acres of HMAs on BLM-administered lands are within five miles of the REDA. Therefore, the scale of impacts would be reduced.	REDA: Similar to Alternative 1. Under this alternative, approximately 2,600 acres of HMAs on BLM-administered lands are within five miles of the REDA. Therefore, the scale of impacts would be reduced.	REDA: Same as Alternative 1. Design features that limit the withdrawal of groundwater under this alternative may reduce the potential for impacts on water availability for wild horses and burros in HMAs adjacent to the REDA. Total acres of HMAs within five miles of the REDA are the same as Alternative 1.	REDA: Similar to Alternative 1. Under this alternative, approximately 8,300 acres of HMAs on BLM-administered lands are within five miles of the REDA. Therefore, the scale of impacts would be reduced.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		area may impact wild horse and burro herds. Water is a limited resource throughout much of the planning area and may partially dictate the capacity of a habitat to support wild horses and burros.					
	N/A	Proposed SEZ: The proposed SEZ would have negligible impacts on wild horses and burros as it is not within or adjacent to any HMAs.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 1.
Wilderness Characteristics	Solar and wind energy development would continue to be authorized through the lands and realty program via a ROW grant. Because solar and wind energy development would diminish wilderness characteristics, it is assumed that such actions would not be permitted on lands managed to maintain these characteristics. As such, wilderness characteristics of these lands would be provided some direct protection from impacts associated with solar and wind energy development. If solar or wind energy development were to occur on lands with wilderness characteristics but not managed to maintain these	REDA: Lands with wilderness characteristics have been eliminated from consideration as a REDA. Therefore, negligible direct impacts on lands with wilderness characteristics are anticipated. However, lands with wilderness characteristics may experience indirect impacts from solar and wind energy development on BLM-administered lands adjacent to or within the viewshed of the eliminated areas similar to those described in the No Action Alternative. 2,300 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted by solar	REDA: Similar to Alternative 1. 2,300 acres of lands with wilderness characteristics managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted by solar and wind energy development. Similarly, 49,400 acres of lands with wilderness characteristics but not managed to maintain these characteristics under the applicable RMP are within five miles of the REDA and could also be indirectly impacted.	REDA: Similar to Alternative 1. 2,300 acres of lands with wilderness characteristics managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted by solar and wind energy development. Similarly, 44,600 acres of lands with wilderness characteristics but not managed to maintain these characteristics under the applicable RMP are within five miles of the REDA and could also be indirectly impacted.	REDA: Same as Alternative 1.	REDA: Similar to Alternative 1. 1,100 acres of lands with wilderness characteristics managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted by solar and wind energy development. Similarly, 3,400 acres of lands with wilderness characteristics but not managed to maintain these characteristics under the applicable RMP are within five miles of the REDA and could also be indirectly impacted.	REDA: Similar to Alternative 1. 2,300 acres of lands with wilderness characteristics managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted by solar and wind energy development. Similarly, 61,500 acres of lands with wilderness characteristics but not managed to maintain these characteristics under the applicable RMP are within five miles of the REDA and could also be indirectly impacted.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
	characteristics, the impacts could result in reducing wilderness characteristics in the project area. For all lands with wilderness characteristics, potential impacts from solar and wind development adjacent to or within the viewshed of the lands with wilderness characteristics could include light pollution and visual intrusions. The magnitude of impact would vary by field office and would depend upon RMP decisions, including ROW allocations (e.g., exclusion and avoidance), VRM class, and existing land uses.	and wind energy development. Similarly, 79,700 acres of lands with wilderness characteristics but not managed to maintain these characteristics under the applicable RMP are within five miles of the REDA and could also be indirectly impacted. Implementing the management actions, design features, and BMPs are anticipated to reduce impacts on lands with wilderness characteristics.					
	N/A	Proposed SEZ: Under Alternative 1, the lands with wilderness characteristics currently managed to maintain these characteristics would continue to be managed to maintain these characteristics. A total of 9,660 acres of land with wilderness characteristics were identified within the proposed SEZ, none of which are being managed to maintain wilderness characteristics. Impacts	Proposed SEZ: Similar to Alternative 1, except that 1,700 acres of land managed to maintain wilderness characteristics would be within the proposed Agua Caliente SEZ.	Proposed SEZ: Similar to Alternative 1, except that 370 acres of land managed to maintain wilderness characteristics would be within the proposed Agua Caliente SEZ.	Proposed SEZ: Same as Alternative 1.	N/A	Proposed SEZ: Same as Alternative 2.

Table 2-13 *(continued)*
Summary of Environmental Consequences by Alternative

Resource	No Action	Alternative 1: Maximum REDA	Alternative 2: Transmission Line and Utility Corridor REDA	Alternative 3: Load Offset REDA	Alternative 4: Water Conservation and Protection REDA	Alternative 5: Land Tenure REDA	Alternative 6: Collaborative-Based REDA
		from solar development on these lands would diminish both the naturalness of the area and opportunities for solitude and primitive or unconfined recreation to the degree that these characteristics may cease to exist in the area, resulting in a reduction in total acres of lands with wilderness characteristics. Implementing the management actions, design features, and BMPs are anticipated to reduce impacts on lands with wilderness characteristics.					

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CHAPTER 3
AFFECTED ENVIRONMENT

This chapter provides a general description of the affected environment in Arizona for the entire planning area and a more detailed description of the affected environment of the proposed Agua Caliente SEZ. The affected environment described in in this chapter provides the basis for identifying the potential impacts described in **Chapter 4**, Environmental Consequences, and **Chapter 5**, Cumulative Impacts.

3.1 INTRODUCTION

Chapter 3, Affected Environment, presents a general description of the existing conditions and trends of resources and resource uses in the planning area that may be affected by implementing BLM's proposed alternatives as well as site-specific information relevant to the proposed Agua Caliente SEZ. The description of the affected environment in this chapter provides the basis for identifying potential impacts and is of sufficient detail to support the programmatic nature of this EIS. Climate change, a topic that may have an influence on the current conditions and potential trends of individual resources and resource uses, has been incorporated as a stand-alone topic.

The **planning area** is the geographic area within which the BLM will make decisions during a planning effort. A planning area boundary includes all lands regardless of jurisdiction; however, the BLM will only make decisions on lands that fall under the BLM's jurisdiction. For the RDEP, the planning area includes the entire state of Arizona but does not include Indian reservation lands or military lands.

The BLM Arizona manages large acreages of diverse public lands across the state, with topography ranging from low deserts to high mountains. The land uses are as varied as the terrain and include livestock grazing; fish and wildlife habitat; oil, gas, and mineral exploration and development; ROW authorizations; and a wide range of outdoor recreation activities. These uses are managed within a framework of numerous public land laws, the most comprehensive of which is the Federal Land Policy and Management Act of 1976. FLPMA establishes several fundamental policies regarding the management of public lands, including the policy directing that lands be managed "…on the basis of multiple use and sustained yield unless otherwise specified by law" (Section 102(a) of FLPMA).

"Multiple use" means management so that "public lands and their various resource values…are utilized in the combination that will best meet the present and future needs of the American people" (Section 103(c) of FLPMA). "Sustained yield" means the achievement and maintenance in perpetuity of a high level or regular periodic output of the variable renewable resources of the public lands consistent with multiple use (Section 103(h) of FLPMA).

The uses to which public lands are dedicated and the allocation of those uses is identified in BLM land use plans called resource management plans (see **Figure 3-1**, Arizona BLM Land Use Plans). RMPs are periodically prepared and revised through an open process that encourages input from the public and interest groups regarding the mix of potential uses of the public lands. Arizona has 16 land use plans throughout the state; 7 of them may be amended by decisions being evaluated in this EIS.

The status of public lands in Arizona is constantly changing with the approval of new ROWs, land exchanges, withdrawals, and the implementation of land use plan and management decisions. Some of these changes could be very large, such as military base expansions; could happen through legislation expanding or creating protected lands, such as creation of a National Monument; or could occur through ongoing consideration of applications for renewable energy development on BLM-administered lands.

3.2 AIR QUALITY AND AIR QUALITY-RELATED VALUES

Ambient air quality is affected by the type and amount of air pollutants emitted into the atmosphere, the size and topography of the air basin, prevailing meteorological conditions, and the conversion of air pollutants and other species by a complex series of chemical and photochemical reactions in the atmosphere. The levels of air pollutants are generally expressed in terms of concentration, either in units of parts per million (ppm), parts per billion (ppb), or micrograms per cubic meter ($\mu g/m^3$).

3.2.1 RDEP Affected Environment

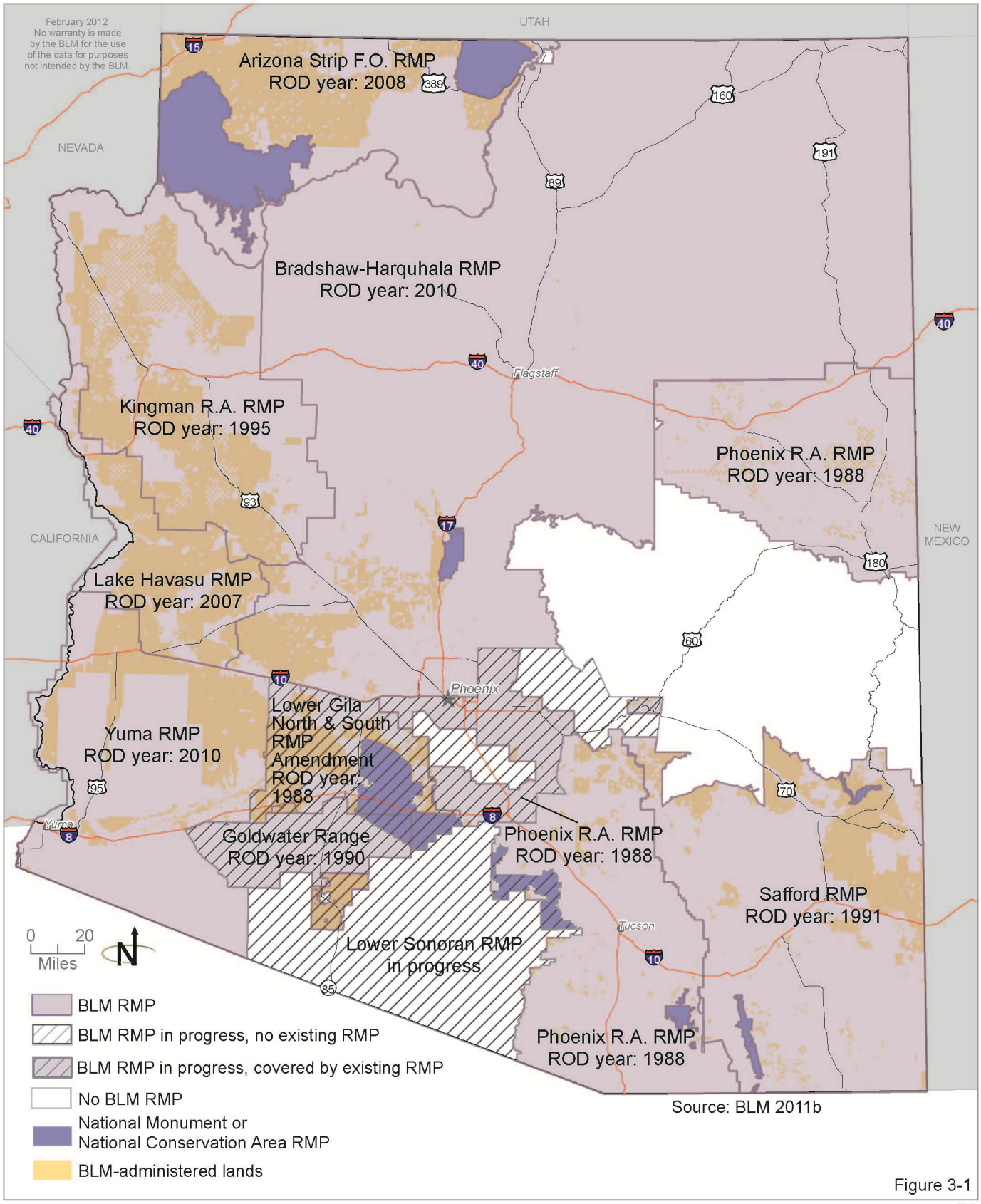
Regulatory Framework

Clean Air Act

The Clean Air Act (CAA) (42 United States Code [U.S.C.] §§ 7401−7642) established the principal framework for national, state, and local efforts to protect air quality in the U.S. Under the CAA, the U.S. Environmental Protection Agency (EPA) has set time-averaged standards known as national ambient air quality standards (NAAQS) for six air pollutants considered to be key indicators of air quality: carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead, and two categories of particulate matter (particulate matter with an aerodynamic diameter of 10 microns or less [PM_{10}] and particulate matter with an aerodynamic diameter of 2.5 microns or less [$PM_{2.5}$]). States may set their own ambient air quality standards, but these standards must be at least as

Arizona BLM Land Use Plans

BLM land use plans called Resource Management Plans (RMPs) identify public lands uses and allocations of uses.



Source: BLM 2011b

Figure 3-1

stringent as the national standards. The State of Arizona has adopted the NAAQS to regulate air pollution in the state.

A NAAQS is composed of two parts – an allowable concentration of a criteria pollutant and an averaging time over which the concentration is to be measured. Averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposure to a high concentration for a short time or to a lower average concentration over a longer period. For some pollutants, there is more than one air quality standard, reflecting both short-term and long-term effects. Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. **Table 3-1**, National and Arizona Ambient Air Quality Standards, lists the standards.

Table 3-1
National and Arizona Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards
	Averaging Time	Level	Level
Carbon Monoxide	8-hour	9 ppm (10 mg/m^3)	None
	1-hour	35 ppm (40 mg/m^3)	None
Lead	Rolling 3-Mo. Average	0.15 µg/m^3	Same as Primary
Nitrogen Dioxide	Annual (Arith. Ave.)	53 ppb	Same as Primary
	1-hour	100 ppb	None
Particulate Matter (PM_{10})	24-hour	150 µg/m^3	Same as Primary
Particulate Matter ($PM_{2.5}$)	Annual (Arith. Ave.)	15.0 µg/m^3	Same as Primary
	24-hour	35 µg/m^3	Same as Primary
Ozone	8-hour	0.075 ppm	Same as Primary
Sulfur Dioxide	3-hour	None	0.5 ppm
	1-hour	75 ppb	None

Source: EPA 2011d

The CAA also regulates toxic air pollutants, or hazardous air pollutants, that are known or suspected to cause cancer or other serious health effects or adverse environmental impacts. EPA has issued rules covering 80 categories of major industrial sources as well as categories of smaller sources. Solar and wind generation facilities are not among these sources.

Clean Air Act Conformity Requirements

Section 176(c) of the CAA requires that federal actions conform to the appropriate State Implementation Plan. A State Implementation Plan is a plan developed at the state level that provides for the implementation, maintenance, and enforcement of NAAQS and is enforceable by the EPA. The EPA has

promulgated rules establishing conformity analysis procedures for transportation-related actions and for other general federal agency actions (40 CFR Parts 6, 51, and 93). The EPA general conformity rule requires preparation of a formal conformity determination document for federal agency actions that are undertaken, approved, or funded in federal nonattainment or maintenance areas when the total net change in direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specified thresholds. No conformity determination has been prepared for this EIS, as no specific wind or solar renewable energy actions are being proposed. Project-specific NEPA analysis would include a determination of project conformance with the CAA general conformity rule.

Prevention of Significant Deterioration

Prevention of Significant Deterioration (PSD) regulations prevent areas that are in attainment of the NAAQS from being polluted up to the level of the standards. PSD regulations place limits on the total increase in ambient pollution levels above established baseline levels for sulfur dioxide, nitrogen dioxide, and PM_{10}.

Air quality control regions are classified either as Class I, II, or III to indicate the degree of air quality deterioration that the state or federal government will allow while not exceeding the NAAQS. Class I areas are special areas of natural wonder and scenic beauty, such as national parks, some national monuments, and wilderness areas, where air quality should be given special protection. Class II areas allow a moderate change in air quality due to industrial growth while still maintaining air quality that meets the NAAQS. No Class III areas have been designated in the U.S. Class I areas are subject to more stringent PSD limits than Class II areas. Actions located farther than 100 kilometers from Class I areas are generally presumed to not impact air quality-related values of the Class I area.

There are twelve Class I airsheds in Arizona: Chiricahua National Monument Wilderness, Chiricahua Wilderness, Galiuro Wilderness, Grand Canyon National Park, Mazatzal Wilderness, Mount Baldy Wilderness, Petrified Forest National Park, Pine Mountain Wilderness, Saguaro Wilderness, Sierra Ancha Wilderness, Superstition Wilderness, and Sycamore Canyon Wilderness **(Figure 3-2**, Class I Airsheds). The remaining areas are classified as Class II areas. As shown in **Figure 3-2**, the majority of Arizona is classified as Class II under PSD guidelines, including all BLM-administered land. In addition, there are three Class I areas in Utah (Bryce Canyon, Zion, and Capitol Reef National Parks), one Class I area in Colorado (Mesa Verde National Park), one Class I area in New Mexico (Gila Wilderness), and one Class I area in California (Joshua Tree Wilderness) that are within 100 kilometers of Arizona. PSD requires major sources or major modification of sources to obtain permits for attainment pollutants. Solar and wind generation facilities are not rule-listed

Class 1 Airsheds

The Clean Air Act, as amended, protects visibility and other air-quality related values within sensitive Class I areas such as wilderness areas and national parks.

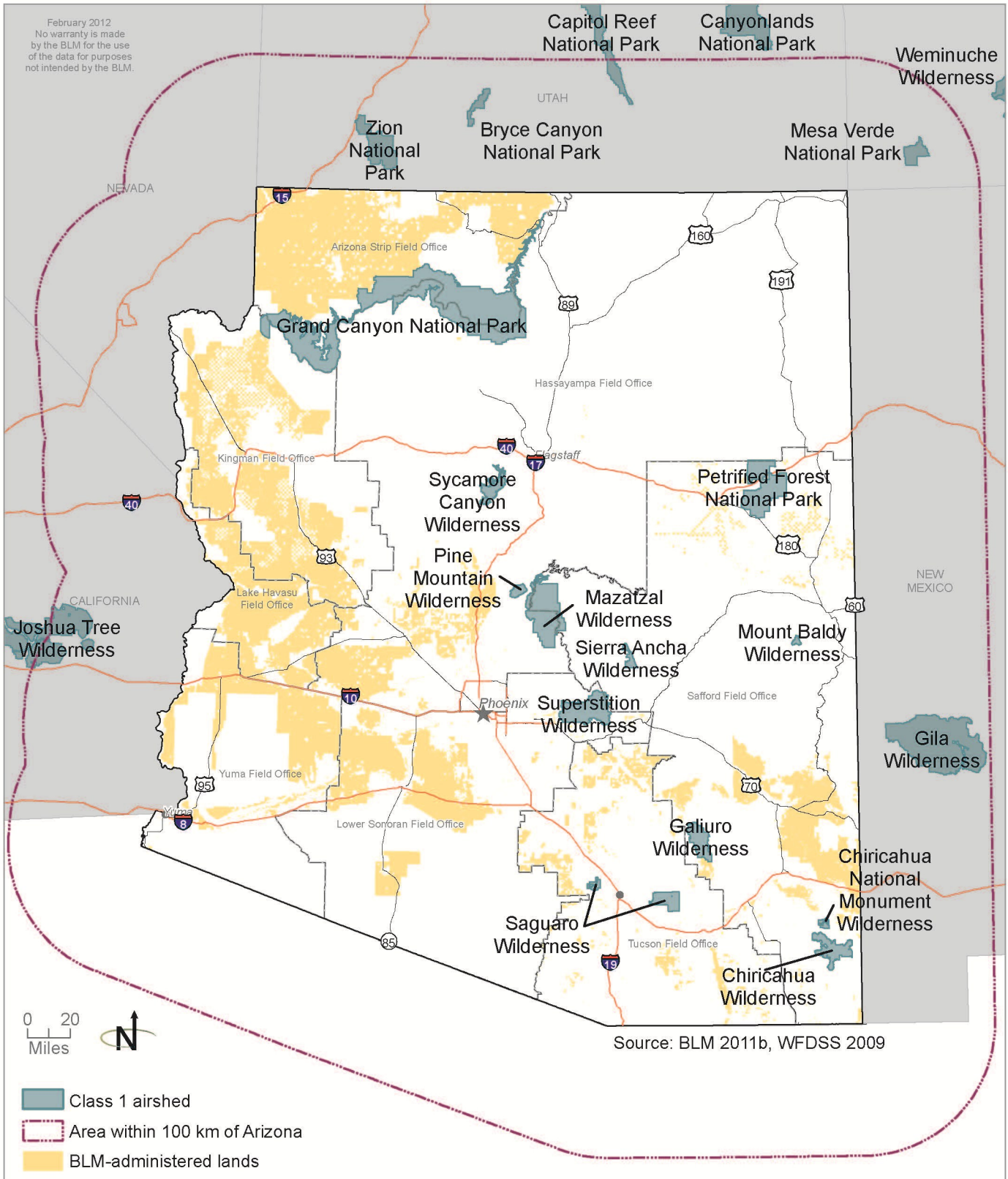


Figure 3-2

emissions sources; therefore, the PSD trigger levels are 250 tons per year for each criteria pollutant emitted during individual facility operations.

Regional Air Quality

Based on measured ambient criteria air pollutant concentrations, the EPA classifies areas of the U.S. according to whether they meet the NAAQS. Areas that violate air quality standards are designated as nonattainment areas for the relevant criteria air pollutants. Nonattainment areas are sometimes further classified by degree (marginal, moderate, serious, severe-15, severe-17, and extreme for ozone, and moderate and serious for carbon monoxide and PM_{10}). Areas that comply with air quality standards are designated as attainment areas for the relevant criteria air pollutants. Areas that have been redesignated from nonattainment to attainment are considered maintenance areas. Areas of uncertain status are generally designated as unclassifiable but are treated as attainment areas for regulatory purposes.

Figure 3-3, Nonattainment and Maintenance Areas, shows the portions of Arizona that are not in attainment with the NAAQS (nonattainment areas) or that have been reclassified from nonattainment to attainment (maintenance areas). **Table 3-2**, Nonattainment and Maintenance Areas and CAA Conformity Threshold Levels, describe these areas and lists the applicable CAA conformity threshold limits.

3.2.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ, in southwest Arizona, in not within 100 kilometers of a Class I area and is in attainment for all NAAQS.

3.3 GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

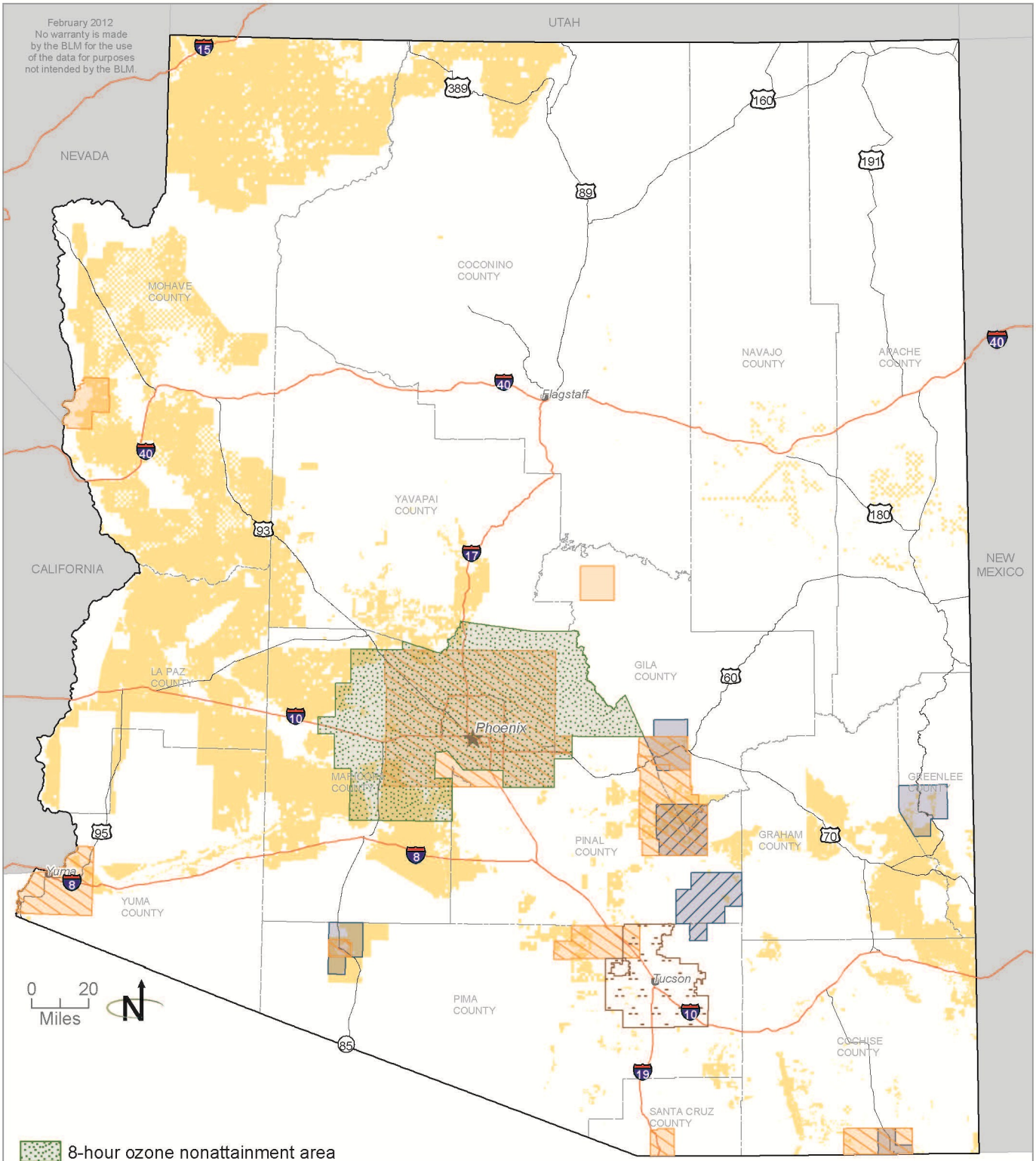
Greenhouse gases (GHG) are chemical compounds in the Earth's atmosphere that allow incoming short-wave solar radiation but absorb long-wave infrared radiation re-emitted from the Earth's surface, trapping heat. Most studies indicate that the Earth's climate has warmed over the past century due to increased emissions of GHGs, and that human activities affecting emissions to the atmosphere are likely an important contributing factor (U.S. Energy Information Administration 2010).

Gases exhibiting greenhouse properties come from both natural and human sources. Water vapor, carbon dioxide, methane, and nitrous oxide are examples of GHGs that have both natural and manmade sources, while other GHGs such as chlorofluorocarbons are exclusively manmade. In the U.S., most GHG emissions are attributed to energy use.

Such emissions result from combustion of fossil fuels used for electricity generation, transportation, industry, heating, and other needs. Energy-related carbon dioxide emissions represent 82 percent of total manmade GHG emissions in the U.S. (U.S. Energy Information Administration 2010).

Nonattainment and Maintenance Areas

Most of Arizona is in attainment with the national ambient air quality standards. Areas of nonattainment are associated primarily with urban areas in southern Arizona.



Source: ADEQ 2008, BLM 2011b

Figure 3-3

Table 3-2
Nonattainment and Maintenance Areas and CAA Conformity Threshold Levels

County	Nonattainment Area	Maintenance Area	CAA Conformity Threshold Value
		PM_{10}	
Cochise	Paul Spur/Douglas area (moderate)	--	100 tons per year in moderate PM_{10} nonattainment areas and maintenance areas
Gila	Hayden area (moderate) Miami area (moderate)	Payson area	
Maricopa	Phoenix area (serious)	--	
Mohave	--	Bullhead City area	
Pima	Ajo area (moderate) Rillito area (moderate)	--	
Pinal	Hayden area (moderate) Phoenix area (serious)	--	70 tons per year in serious PM_{10} nonattainment areas
Santa Cruz	Nogales area (moderate)	--	
Yuma	Yuma area (moderate)	--	
		$PM_{2.5}$	
Pinal	West Central Pinal area	--	100 tons per year each directly emitted $PM_{2.5}$; sulfur dioxide; and (if determined to be a significant precursor) nitrogen oxides, volatile organic compounds, and ammonia
Santa Cruz	Nogales area	--	
		8-hour Ozone Standard	
Maricopa	Phoenix area (serious)	--	50 tons per year each volatile organic compounds and nitrogen oxides in serious nonattainment areas
Pinal	Phoenix-Mesa area (serious)	--	
		Sulfur Dioxide (primary standard)	
Cochise	--	Douglas area	100 tons per year in nonattainment areas and maintenance areas
Gila	--	Miami area	
Greenlee	--	Morenci area	
Pima	--	Ajo area	
Pinal	Hayden area	San Manuel area	
		Carbon Monoxide	
Maricopa	--	Phoenix area	100 tons per year in maintenance areas
Pinal	--	Tucson area	

Source: EPA 2011e; 40 CFR 93 Subpart B

Computer-based modeling suggests that rising GHG concentrations generally produce an increase in the average temperature of the Earth, which may produce changes in sea levels, rainfall patterns, and intensity and frequency of extreme weather events. Collectively, these effects are referred to as "climate change." The Intergovernmental Panel on Climate Change, in its Fourth Assessment Report, stated that warming of the earth's climate system is unequivocal and that warming is very likely due to anthropogenic GHG concentrations (Intergovernmental Panel on Climate Change 2007).

3.3.1 RDEP Affected Environment

In Arizona, GHG emissions have historically increased. Between 1990 and 2005, Arizona's net GHG emissions increased by nearly 56 percent, from an estimated 59.3 million metric tons carbon dioxide equivalent to an estimated 92.6 million metric tons carbon dioxide equivalent. In addition, electricity use accounts for nearly 40 percent of Arizona's gross GHG emissions, or about 35 million metric tons carbon dioxide equivalent (ACCAG 2006). However, in 2011 the EPA began regulating GHGs in the state. GHGs have been added to the list of pollutants covered under air quality permits (McKinnon 2011).

Arizona's GHG emissions are forecasted to increase by 148 percent from 1990 to 2020, taking into account the effects of recent energy efficiency actions adopted by the state in the 2006 Arizona Climate Change Action Plan (ACCAG 2006). A few of the actions proposed by the Climate Change Action Plan to reduce Arizona's GHG emissions include renewable energy incentives and tax credits, biodiesel/ethanol implementation, reforestation, and manure management/digesters. A complete list of the Climate Change Action Plan proposed actions and their corresponding reductions in GHG emissions can be found in the Arizona Climate Change Action Plan (ACCAG 2006). Without these actions, emissions growth in 2020 would be forecasted to increase by 159 percent over 1990 levels (ACCAG 2006).

3.3.2 Agua Caliente Solar Energy Zone Affected Environment

As stated above for the state of Arizona, GHG emissions have also increased in the region of the proposed Agua Caliente SEZ. However, due to the rural nature of the proposed Agua Caliente SEZ, the increase in emissions are not as large as more developed areas. Current activities on the proposed Agua Caliente SEZ generate low levels of GHG emissions and are primarily associated with vehicles and farm equipment.

3.4 CULTURAL RESOURCES

Cultural resources encompass a range of archaeological, traditional, and built resources that may include sites, structures, buildings, roads, trails, spiritual/sacred places, districts, and objects that are significant in regard to history, prehistory, architecture, archaeology, engineering, and/or cultural heritage. This term also may apply generally to non-tangible cultural practices (e.g., cultural uses of the natural environment).

Under the National Historic Preservation Act (NHPA), significant cultural resources are those "historic properties" that are eligible for nomination to the National Register of Historic Places (NRHP). To be NRHP eligible, a property must be at least 50 years old (with rare exceptions) and possess integrity of location, design, setting, materials, workmanship, feeling, and association. A site, building, structure, or district may be determined eligible if it meets at least one of four criteria (36 CFR 60.4):

- Criterion A: Associated with events that have made a significant contribution to the broad patterns of our history;
- Criterion B: Associated with the lives of persons significant in our past;
- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values; or
- Criterion D: Have yielded, or may be likely to yield, information important in prehistory or history.

NRHP-eligible locations that meet these criteria may also include traditional cultural properties (TCP). NRHP Bulletin 38 (Parker and King 1998) defines a TCP as an eligible historic property that has an association with cultural practices or beliefs of a living community that are "rooted in that community's history," or "are important in maintaining the continuing cultural identity of the community." Although TCPs may be associated with living communities of various ethnic or cultural groups, they are an especially important consideration for Native American groups. Properties that possess such significance may include locations where tribal religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice; and locations where a community has traditionally carried out economic, artistic, or other cultural practices important in maintaining its cultural heritage. Although tribal consultation under Section 106 of the NHPA may provide for the identification of TCPs, it is not uncommon for tribal members to be reticent to discuss or disclose the location of such sites to outside interests. As such, government-to-government consultation involving face-to-face meetings may be the only way to identify this information and to protect its confidentiality to the extent provided by law.

In addition to the NHPA, the BLM is obligated under the FLPMA, NEPA, and agency policy to protect cultural resource values and to consider and mitigate the potential impacts of proposed activities and land use plans. The BLM also allocates cultural resources to use categories, such as scientific and educational uses, that could be affected by renewable energy development.

3.4.1 RDEP Affected Environment

Cultural resources are present throughout Arizona, resulting from at least 10,000 years of human history. Although the numbers, density, and distribution of the resources vary widely over geographic areas, it is expected that some cultural resources are present within each proposed REDA.

BLM-administered lands in Arizona account for 12.2 million acres; about 817,400 acres (6.7 percent) had been surveyed for cultural resources by 2003 (Jarvis 2006). Jarvis estimated a rate of 1 cultural resource site per 59.5 acres for BLM lands in the 11 western states. Using this estimate, **Table 3-3**, Predictive Model for Previously Unrecorded Cultural Resources within the Six Proposed REDA Alternatives, shows the predicted number of new cultural sites under each REDA alternative (not including the Agua Caliente SEZ).

Table 3-3
Predictive Model for Previously Unrecorded Cultural Resources within the Six Proposed REDA Alternatives

Alternative		Total BLM-administered Lands (acres)	Unsurveyed Acres[1]	Predicted Number of New Cultural Resources[2]
Alternative 1		307,644	287,032	4,824
Alternative 2		201,827	188,305	3,165
Alternative 3		106,573	99,433	1,671
	WPZ 1	110,997	103,560	1,741
Alternative 4	WPZ 2	134,349	125,348	2,107
	WPZ 3	46,159	43,066	724
Alternative 5		21,523	20,081	337
	WPZ 1	61,650	57,519	968
Alternative 6	WPZ 2	100,702	93,955	1,579
	WPZ 3	44,783	41,783	702

Source: Rayle and Swanson 2011
[1]Calculations based on the assumption that approximately 6.7 percent of BLM-administered lands in Arizona have been subject to archaeological survey.
[2]Calculations based on the rate of 1 site per 59.5 acres.
WPZ= Water Protection Zone

Although the predictive equation provides a means for estimating the potential number of new cultural resources for each of the six proposed REDA alternatives, these are general estimates that do not take into account the exclusion of culturally sensitive areas, and do not attempt to direct development toward areas of relatively low sensitivity. Specifically, the statewide estimates are skewed due to the inclusion of areas of high site density that are not part of the REDA, and it is reasonable to expect that the potential of new cultural resources would be lower than the estimates in **Table 3-3**, Predictive Model

for Previously Unrecorded Cultural Resources within the Six Proposed REDA Alternatives.

The BLM recently completed intensive inventories (surveys) for proposed renewable energy projects in western Arizona, which are included in the REDA under most alternatives. These include three proposed solar energy projects (Sonoran Solar, Quartzsite, and Hyder) and one wind project (Mohave County Wind Farm). For these projects, the total area surveyed is 25,224 acres. The surveys recorded 55 archaeological sites (33 historic period sites and 22 prehistoric or Native American sites). The overall average is 1 site per 459 acres, a much lower density than the estimate of 1 site per 59.5 acres. As such, it is expected that, based on local conditions, there would be a range of 2 to 10 sites per square mile (640 acres).

Based on an initial statewide assessment of potential REDA locations, REDAs in geographic areas containing similar histories or cultural characteristics were grouped in order to facilitate the EIS analysis. Labels assigned to these areas reflect either their geographic locations or the prehistoric cultural traditions affiliated with these areas. Boundaries for these cultural regions were drawn to group the REDAs and may include areas that have not been proposed as a REDA. These cultural regions include:

- Lower Gila;
- Southern Patayan;
- Northern Patayan;
- Tusayan/Northern Plateau;
- Little Colorado;
- Safford/San Simon;
- Santa Cruz/Tucson; and
- Phoenix Basin/Middle Gila.

With these cultural regions defined, EPG, Inc. conducted a limited Class I records search to summarize and provide an overview of resources throughout the state (**Figure 3-4**, RDEP Cultural Regions). A standard Class I review, incorporating detailed data from the statewide Arizona Archaeological Site and Survey Database (AZSITE) database, would be beyond the scope of this EIS; therefore, the review focused on the types of sites known to exist in each region and any historic properties currently listed on the NRHP within or near the proposed REDAs. For more-detailed information regarding relevant cultural histories, as well as the general site types that might be located within each of these eight regions, see Rayle and Swanson (2011), or refer to **Appendix D**, Cultural History Background of Arizona.

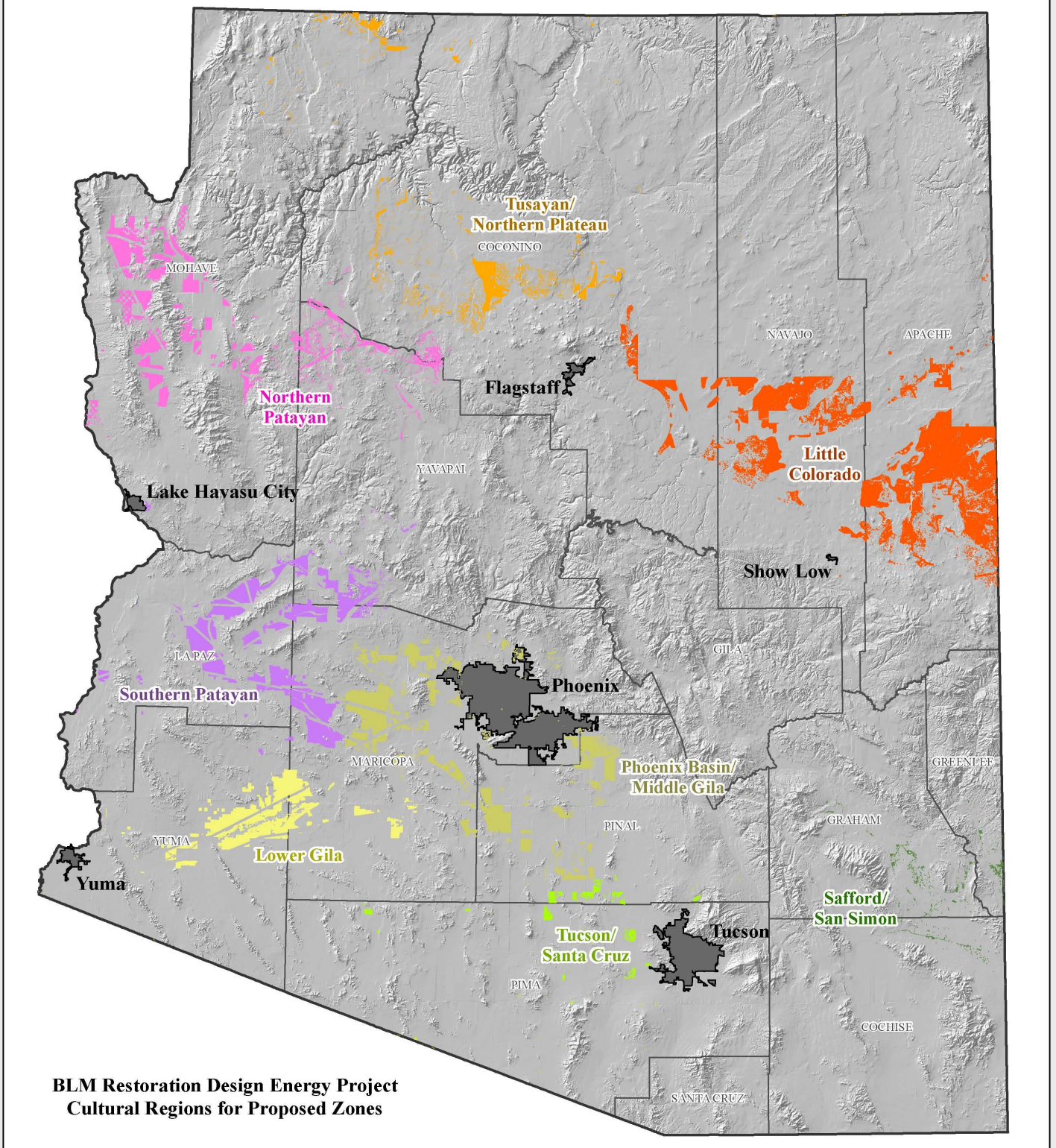


Figure 3-4

Sources:
EPG 2011; ESRI 2010;

November 07, 2011

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Lower Gila Cultural Region

This region of southwestern Arizona includes areas along the lower Gila River in Yuma County, extending eastward into Maricopa County. Much of the area identified in potential REDA zones includes private land used for agriculture. This region includes the proposed Agua Caliente SEZ on BLM-administered land.

Prehistoric cultural resources are affiliated primarily with the Archaic and Patayan cultural traditions. Site densities tend to be higher within one to two miles of the Gila River, including scatters of artifacts, pit houses, and other features that represent the remnants of dispersed villages and seasonal camps. Some areas near the river have concentrations of trails, rock art, and rock alignments that may have been associated with ceremonial activities. Trails along the river attest to its importance as a travel corridor.

Prehistoric site types include habitation sites, temporary camps, petroglyphs and pictographs, rock rings, intaglios and geoglyphs (designs created by scraping away "desert pavement" from the surface or making rock alignments), trails, hearths, quarries, and scatters of stone or ceramic artifacts deposited while hunting, gathering, or processing plants, raw materials, or other resources. These sites are located within a variety of environmental zones and attest to frequent and patterned movements across the landscape in the course of seasonal resource exploitation. Sites tend to be located near water sources, such as springs, tinajas, or larger washes, or other areas that offered concentrations of resources, such as cacti on the higher zones of desert basins. Some areas of the desert basins have a low incidence of archaeological sites (Stone 1986). However, on-the-ground surveys would be needed to identify the presence and distribution of sites within specific REDAs.

Many historic trails, roads, and railroads, including the Juan Bautista de Anza National Historic Trail, Butterfield Overland Mail Route, and Mormon Battalion Trail, followed the Gila River. Historic site types include trails, roads, railroads and associated facilities and work camps, mining sites, irrigation facilities, homesteads, ranches, and cemeteries. Historic sites are often located at or near the same locations as prehistoric sites, indicating similar needs for access to water and other resources. Also, this region may contain historic sites associated with military training activities in the Desert Training Center/ California-Arizona Maneuver Area during World War II, specifically in the vicinities of Camps Horn and Hyder.

NRHP listings in the vicinity of proposed REDAs include three historic structures. Two listed archaeological districts, Sears Point and Painted Rocks, are excluded from REDAs but could be subject to visual impacts of renewable energy development.

Southern Patayan Cultural Region

This region of western Arizona includes desert basins and mountains in portions of La Paz, Maricopa, and Yavapai Counties. Prehistoric cultural resources are affiliated primarily with the Archaic and Patayan cultural traditions. Archaeological and ethnographic evidence indicates that some groups lived in this area year round, traveling seasonally to exploit wild resources, or went to live temporarily along the lower Colorado River, while groups who lived along the river often ventured into the deserts and uplands to hunt and exploit wild foods and other natural resources (Stone 1986, 1991).

Prehistoric and historic site types are similar to those of the Lower Gila Cultural Region. This region was also part of the Desert Training Center/California-Arizona Maneuver Area and was the location of Camp Bouse. Likewise, archaeological sites tend to be located near water sources, such as springs and large washes, and in or near the mountain ranges that contained relatively abundant game, wild food plants, and raw materials or minerals, such as the Eagletail, Harquahala, and Harcuvar mountains. The broad desert basins tend to have lower site densities, yet concentrations of Archaic and Patayan camps have been found along major washes or in areas where temporary pools of water formed during rainy seasons or wetter climates. Many of the REDAs in this region are on private lands that have been devoted to agriculture, and it is also the location of the Brenda SEZ, nominated in the Supplemental Draft Solar PEIS (BLM and DOE 2011).

NRHP listings in the vicinity of proposed REDAs include the Eagletail Petroglyph Site and the historic Harquahala Peak Smithsonian Observatory, both of which are excluded from development but could be subject to visual impacts from renewable energy facilities. The listings also include three historic structures or ranches near Quartzsite, Wenden, and Wickenburg.

Northern Patayan Cultural Region

This region in northwestern Arizona extends from the Colorado River through the desert basin and range province to the western edge of the Colorado Plateau, in Mohave, Yavapai, and Coconino Counties. Prehistoric cultural resources are affiliated primarily with the Archaic, Patayan, and Cohonina cultural traditions. In addition, trade and travel routes across Arizona linked the various tribes to groups in present-day California and New Mexico.

Prehistoric and historic site types are similar to those in other regions of western Arizona. Caves and rock shelters were frequently used for habitation and storage. Structures of rock masonry, known as pueblos, were used as habitations in later time periods. Small structures on hill tops may have had defensive functions or served as lookouts or signaling stations. Historic roads, railroads, and trails, many of which followed prehistoric routes, are a conspicuous type of historic archaeological feature in this region, along with sites associated with mining and ranching.

Archaeological site densities appear to be higher along the Colorado River and other streams, in the area between the Colorado River and the Black Mountains, and in mountain ranges and canyons. Sites are also present in some valleys and basins, such as the area surrounding Red Lake playa, which offered water, areas suitable for farming, or relatively dense concentrations of edible plant seeds. Other arid basins, such as the Detrital Valley, and the high Plateau grasslands appear to be areas of relatively low site density (Stone 1987).

Sites listed on the NRHP in the vicinity of REDA zones include the Seligman Commercial Historic District and eight historic buildings, roads, or structures in the vicinity of Kingman, Ash Fork, and Bullhead City. Two listed structures on the Hualapai Indian Reservation would not be affected by development within the REDAs.

Tusayan/Northern Plateau Cultural Region

This region includes lands in northern Arizona on the Colorado Plateau in Coconino and Mohave Counties. Prehistoric cultural resources are affiliated primarily with the Archaic, Cohonina, Cerbat, Sinagua, and Ancestral Puebloan traditions. Major types of prehistoric sites are pithouse villages, pueblo settlements, caves, farming-related features, petroglyphs and pictographs, trails, and artifact scatters representative of camping and resource exploitation. This area also contains many quarries associated with rich sources of obsidian, a volcanic glass that was widely traded throughout Arizona for the manufacture of stone tools. It is difficult to clearly associate the distribution of sites with environmental zones, though many site concentrations of higher density are located near the base of major mountain peaks and near the obsidian sources.

Historic sites are associated with ranching, logging, mining, and transportation as well as the management of national forests and the development of tourism at the Grand Canyon. Camps and activities of the Civilian Conservation Corps also are evident in the archaeological record.

Many of the NRHP-listed sites in this region are within areas of the Kaibab and Coconino National Forests and Grand Canyon National Park that would be unlikely to be affected by renewable energy development in the proposed REDAs. However, visual impacts may be of concern. The Grand Canyon Railway, between Williams and Tusayan, is listed as a historic district and could be affected by visual impacts of renewable energy development.

Little Colorado Cultural Region

This region of northeastern Arizona spans the Colorado Plateau in Apache and Navajo Counties and eastern Coconino County. Prehistoric cultural resources are affiliated primarily with the Archaic, Sinagua, and Ancestral Puebloan cultural traditions. Major types of prehistoric sites are pithouse villages, pueblo settlements, farming-related features, petroglyphs and pictographs, trails, and artifact scatters representative of camping and resource exploitation. Many of the pueblo sites consist of large villages containing several hundred rooms and

circular ceremonial chambers known as kivas. Areas along the Little Colorado River and on mesa tops tend to have high site densities, as does the Petrified Forest National Park and adjacent zones, though site densities vary across the landscape. Archaeological sites of Navajo and Apache ancestors, who had a relatively mobile lifestyle, can be ephemeral and difficult to detect but include the foundations of temporary brush shelters. Sites of the historic period are associated with ranching, logging, mining, and the construction of major railroads and highways.

The NRHP listings for Navajo and Apache counties (outside of Indian reservations) include at least 15 prehistoric archaeological sites or districts whose location is given as "address restricted" for their protection. Some of these sites could be within or near REDAs. In addition, there are at least 30 listed historic sites and districts, consisting mainly of buildings within and near Holbrook and Winslow, highways, and highway bridges. About 19 of these locations could be subject to potential impacts based on their proximity to REDAs.

Safford/San Simon Cultural Region

This region in southeastern Arizona includes lands in the San Simon Valley near Safford in Graham and Greenlee Counties. Prehistoric cultural resources are affiliated primarily with the Paleoindian, Archaic, Ancestral Puebloan (primarily Mogollon), and Hohokam cultural traditions.

Spanning an extremely long range of time, this region includes notable occurrences of ancient Paleoindian and Archaic sites, some of which may be deeply buried and therefore subject to discovery during construction activities. Prehistoric site types include pit house and masonry structures; agricultural features (including the extensive "waffle garden" series of rock alignments near Safford); petroglyphs and pictographs; Hohokam ball courts; and artifact scatters representing a variety of activities and resource uses. Sites of the historic period are associated with ranching, mining, Spanish settlement and exploration, 19th century military campaigns, and activities associated with the Civilian Conservation Corps. Sites tend to have higher densities near streams and transportation routes.

Listed NRHP properties in the vicinity of REDAs include two prehistoric archaeological districts near Safford whose location is confidential. Most of the listed sites are historic buildings in Safford and other towns, which are remote from proposed REDAs.

Santa Cruz/Tucson Cultural Region

This region in southern Arizona includes lands north and west of Tucson in Pima and Pinal counties. Prehistoric cultural resources are affiliated primarily with the Archaic and Hohokam cultural traditions. Types of prehistoric sites include pit houses and settlements with above-ground architecture; ball courts and platform mounds; canals; other agricultural features such as constructed

terraces and rock pile fields; petroglyphs and pictographs; and artifact scatters. Diverse types of sites are present in a variety of environmental zones, with higher densities of more substantial sites near the Santa Cruz River and other water sources, and on the upper bajada slopes adjacent to mountain ranges. Intricate series of terraces, known as trincheras, were constructed on some steep hill slopes such as Tumamoc Hill in Tucson.

Historic site types are those associated with the settlement and growth of Tucson and surrounding areas, and some are associated with Spanish exploration starting in the 1500s. Sites include homesteads, ranches, mines, trails, roads, military facilities, and missions.

The region includes more than 100 sites and districts that are listed on the NRHP, consisting mostly of historic buildings and structures in Tucson. Some of these could be affected by the development of disturbed sites such as mines and landfills that are nominated as REDAs. Away from the urban area, approximately 17 listed properties may be proximate to REDAs, consisting mainly of historic structures but also including several prehistoric sites and districts.

Phoenix Basin/Middle Gila Cultural Region

This region in south-central Arizona includes lands that surround Phoenix in Maricopa and Pinal Counties. It is the location of the Gillespie SEZ. Prehistoric cultural resources are affiliated primarily with the Archaic, Hohokam, and Patayan cultural traditions. Types of prehistoric sites are similar to those of the Santa Cruz/Tucson region, as are types of historic period sites with the exception of those related to Spanish exploration and missions. Hohokam settlements are concentrated along the Salt, Verde, Agua Fria, and Gila Rivers and extend as far west as the Gila Bend area. The co-occurrence of Hohokam and Patayan artifact types in the western area may indicate social relationships or co-occupation of the same settlements. Away from the rivers, site densities tend to be higher near major water courses and near mountain ranges with productive natural resources.

The region includes more than 300 properties listed on the NRHP, consisting mainly of historic buildings and structures in Phoenix and the surrounding metropolitan area. Outside the urban area, approximately a dozen listed properties, mostly historic buildings and highway bridges, could be proximate to REDAs.

3.4.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ lies on the Palomas Plain in northeast Yuma County, Arizona. EPG, Inc. conducted a Class I cultural resources records check through AZSITE, the Arizona State Historic Preservation Office (SHPO), the BLM Yuma Field Office, and General Land Office (GLO) plat maps available from the BLM. The records search was performed to identify previously completed Class III cultural resource inventories and previously recorded sites within the analysis area. The study area consists of the approximately 22,000-acre planning

area, plus a 1-mile buffer around the planning area, in compliance with SHPO requirements.

No previous archaeological surveys have been conducted within the boundaries of the proposed Agua Caliente SEZ; therefore, no cultural resources have been documented within this area. Fourteen previously recorded sites occur within one mile of the planning area; these sites are shown in **Table 3-4**, Summary of Previously Recorded Cultural Resources. Previously recorded prehistoric sites consist of artifact scatters, some of which contain extant features such as hearths, geoglyphs, trails, and rock rings. All of these prehistoric cultural resources remain unevaluated except for AZ Y:3:28(ASM), a prehistoric lithic scatter that has been recommended as eligible for the NRHP, and AZ-050-2384(BLM), a prehistoric rock ring that has been recommended as not eligible for NRHP listing.

The five previously recorded historic cultural resources consist of a segment of the Southern Pacific Railroad, a segment of the Bunyan-Hyder-Horn 69-kV Power Line, the White Wing Ranch, Camp Horn, and the Horn Railroad Station (see **Table 3-4**, Summary of Previously Recorded Cultural Resources). The SHPO has determined that the Southern Pacific Railroad: Wellton-Phoenix Spur is eligible for inclusion on the NRHP. The White Wing Ranch and Camp Horn have been recommended eligible for inclusion on the NRHP, while the Bunyan-Hyder-Horn 69-kV Power Line and Horn Railroad Station have been recommended as not eligible for NRHP listing.

In addition to the formally recorded sites, unpublished archaeological field maps completed by Malcolm Rogers and Julian Hayden in the 1940s suggest the presence of three prehistoric trails within the study area. The presence of these trails has not been verified on the ground since Rogers initially identified them, and their location is uncertain. Rogers believed that these trails may have served as links between settlements on the Colorado and Gila Rivers. Artifacts, rock rings, and rock piles are frequently associated with prehistoric trails and could also be present in the proposed Agua Caliente SEZ.

There is a high potential for previously unidentified historic military-related cultural resources due to the U.S. Army's presence in the area during World War II. Specifically, the planning area lies in close proximity to Camp Horn and Camp Hyder, two significant World War II-era divisional training camps in operation from 1943 through 1944. Comparison of period maps (Bishcoff 2008) with modern topographic maps of the area reveals that at least three military ranges located northeast of Camp Horn lie directly within the current planning area, and much of this area remains free of agricultural-related disturbance. These ranges consisted of the East Artillery Range and two combat ranges used for .30-caliber small arms training. Moreover, topographic maps and aerial imagery reveal the presence of at least two landing strips within the current

Table 3-4
Summary of Previously Recorded Cultural Resources

Site Number/Name	Description	Size	Eligibility
AZ S:14:6(ASM)	Prehistoric lithic scatter	Unknown	Not evaluated
AZ S:14:7(ASM)	Prehistoric ceramic scatter	Unknown	Not evaluated
AZ S:14:8(ASM)	Prehistoric lithic scatter	Unknown	Not evaluated
AZ S:15:7(ASM)/Bunyan-Hyder-Horn 69/12kV Power Line	Historic power line and access roads	1.4 miles x 200 feet (within study area)	Recommended not eligible
AZ T:10:84(ASM)/Southern Pacific Railroad: Wellton-Phoenix Spur	Historic railroad	7 miles x 200 feet (within study area)	Determined eligible
AZ Y:2:29(ASM)/Horn Railroad Station	Historic railroad station	455 x 375 feet	Recommended not eligible
AZ Y:2:49(ASM)/Camp Horn	Historic Army divisional camp	4.5 miles x 7,392 feet	Recommended eligible
AZ Y:3:28(ASM)	Prehistoric lithic scatter	110 x 45 meters	Recommended eligible
AZ Y:3:29(ASM)	Patayan/Yuman artifact scatter	100 x 100 meters	Not evaluated
AZ Y:3:30(ASM)	Patayan/Yuman artifact scatter with hearths	160 x 150 meters	Not evaluated
AZ Y:3:5(ASM)	Prehistoric camp site	Unknown	Not evaluated
AZ Y:3:70(ASM)/White Wing Ranch	Historic ranch	375 x 300 feet	Recommended eligible
AZ-050-0938(BLM)	Prehistoric geoglyph, trail and lithic scatter	100 x 20 meters	Not evaluated
AZ-050-2384(BLM)	Prehistoric rock ring	2 x 2 meters	Recommended not eligible

planning area. At this time, no archival research has been undertaken to identify these extant airfields; however, it is likely that they are military-related and date to the period of significance at the Desert Training Center/California-Arizona Maneuver Area (1942–1944).

Training of troops at Camp Horn and Camp Hyder consisted of conducting division-scale maneuvers in the area. According to Bischoff (2008, p. 85), planting operations at the White Wing Ranch following the Army's departure resulted in the discovery of several buried crates containing grenades and rifles. Furthermore, local residents claim to have observed a number of exploded and unexploded ordnance in the area, including 20-mm projectiles and cartridges, 2.36-inch bazooka rockets, 81-mm mortars, 25-pound practice bombs, and .50-

caliber bullets and cartridges. Therefore, it is very likely that a Class III cultural survey would result in the identification of historic military-related features, exploded and unexploded ordnance, other small arms bullets and cartridges, and other cultural material directly associated with Camp Horn. As such, a Class III survey would be required for any potential projects within the Agua Caliente SEZ.

3.5 ENERGY AND MINERALS

Arizona contains a variety of energy and mineral resources. This section focuses on those energy and mineral resources that are managed on BLM-administered lands; information on other energy and mineral resources not managed on BLM-administered lands are limited to a general overview. Energy and mineral resources include leasable minerals (both solid and fluid), locatable minerals, mineral materials (salables), and renewable energy. These resources are defined as follows:

- **Leasable minerals** include fluid minerals such as oil, gas, and carbon dioxide (CO_2), and solid minerals such as coal and sodium. Leasable minerals are governed by the Mineral Leasing Act of 1920, as amended, which authorized specific minerals to be disposed of through a leasing system. Geothermal resources are also a leasable mineral and are governed by the Geothermal Steam Act of 1970.
- **Locatable minerals** include both metallic minerals such as gold, silver, and copper, and nonmetallic minerals such as gemstones, silica, and perlite. Locatable minerals rights are established by staking a mining claim in accordance with federal and state laws and regulations. Related mining operations are governed by federal, state, and local environmental and safety laws and regulations.
- **Mineral materials** (or saleable minerals) include common varieties of sand, gravel, aggregate, clay, limestone, cinders, and decorative rock as well as building or dimensional stone.

3.5.1 RDEP Affected Environment

Leasable Minerals

Leasable minerals defined by the Mineral Leasing Act (February 1920; and 43 CFR 3000-3599, 1990) include the subsets leasable solid and leasable fluid minerals. The rights to explore for and produce these minerals on public land may only be acquired through leasing.

Solid Leasable Minerals

Leasable solid minerals discussed in this section include coal, potash, and sodium chloride.

Coal. The two noteworthy coal fields in Arizona, the Black Mesa and Pinedale coal fields, are within the Colorado Plateau in the northern portion of the planning area. The Black Mesa coal field is the most extensive coal reserve in

Arizona and is entirely within the Navajo and Hopi Indian Reservations. It is therefore outside of the project planning area and not discussed further. The Pinedale coal field is in the southern part of Navajo and Apache Counties. The rank of the coal is assumed to be subbituminous (Averitt and O'Sullivan 1969). There is no known production from this coal field (Kirschbaum and Biewick 2000). Smaller remnants of Arizona Cretaceous rocks are indicated in the northern, far eastern, and southeastern portions of the state, but no production has occurred at any of these sites (Peirce et al. 1970).

Potash. The Colorado Plateau east of Holbrook is underlain by a potash deposit estimated by the Arizona Geological Survey (AZGS) to contain between 682 million and 2.27 billion metric tons of mineral (AZGS 2011). The potash is present near the top of extensive salt (halite – sodium chloride) deposits in the Permian Supai formation. The deposit is located many hundreds of feet underground and underlies lands that include private, State Trust, tribal, and National Park Service holdings. The deposit is approximately centered on Petrified Forest National Park, making extraction challenging.

To date there has been no commercial production of potash in Arizona on BLM-administered land or otherwise, either by conventional or solution mining (Rauzi 2008).

Sodium Chloride. Salt of Permian age underlies about 3,500 square miles in the Holbrook Basin on the Colorado Plateau. Massive salt deposits at least 6,000 feet thick and possibly more than 10,000 feet thick have accumulated in the Hualapai Valley north of Kingman and the Luke Basin west of Phoenix (Rauzi 2002). Arizona hosts one solution-mining operation and two liquefied petroleum gas facilities. The solution-mining operation and one of the liquefied petroleum gas facilities are west of Phoenix in the Luke salt deposit. Portions of this deposit lie on BLM-administered subsurface lands. The other liquefied petroleum gas facility is east of Holbrook in the Holbrook salt basin (Rauzi 2002).

Fluid Leasable Minerals

Leasable fluid minerals discussed in this section include helium, geothermal, and oil and gas resources.

Helium. Helium is a valuable gas that has many uses because of its unique physical properties (small atom, extreme mobility, low boiling point and density, and completely inert). Some of the uses include coolant for high-temperature gas-cooled nuclear reactors, lifting gas for balloons and other lighter-than-air activities, and purging and pressurizing fluid in aerospace applications. In the 1960s and 1970s, some of the richest helium-bearing gas in the world was produced from wells in the Holbrook Basin in northeastern Arizona. The only helium production in Arizona at this time, however, is from wells in the Dineh-bi-Keyah oil field on the Navajo Reservation in the Four Corners area (Rauzi

and Fellows 2003). As mentioned previously, the Navajo Reservation is outside the project planning area and therefore is not further discussed.

Geothermal. In May 2008, the BLM signed a ROD for the Geothermal Leasing PEIS, in which the BLM reviewed the potential for geothermal energy on BLM, Bureau of Indian Affairs, and U.S. Forest Service lands in the western U.S., except Alaska. This document serves as the baseline for the assessment of geothermal resources in the planning area.

High-temperature geothermal resources have yet to be discovered in Arizona, and most known resources of any temperature are located south of the Colorado Plateau (BLM 2008b). The BLM has one geothermal lease in eastern Arizona, located in the Safford Field Office (Greenlee County), but no exploration has occurred. Likewise, there is no reported leasing or development activity for geothermal energy resources throughout the state. A resource exploration report was written in 2005 to evaluate the geothermal resources of the Clifton Hot Springs area in Greenlee County for an electric power production project (Brown 2007). Three additional Arizona locations that may warrant exploration are Buckhorn Baths in Apache Junction, Castle Hot Springs in the Bradshaw Mountains, and Childs on the Verde River (BLM 2008b).

Oil and Gas. Proper conditions for formation and accumulation of commercial reservoirs of oil and gas are known to have existed only in the extreme northeastern corner of the state, from which all production in Arizona has come (Duncan and Mancini 1991). These lands are located entirely within the Navajo Reservation, and are therefore outside the scope of the RDEP.

Other areas in Arizona with thick accumulations of sedimentary rocks that have been explored for oil and gas include Holbrook Basin, Mogollon Slope, Pedregosa Basin, and the Gulf of California Embayment. While potential is thought to occur in these areas, none have produced. Furthermore, whether these areas will yield oil and gas is unknown and largely dependent on the intensity with which they are explored (Duncan and Mancini 1991).

Leasable Minerals Summary

As the population in Arizona continues to grow, so will competition for land uses. There is potential for an increased interest and development of leasable minerals in Arizona. Good potash deposits are rare, and there are few global producers despite the growing global demand for potash. As a result, the potash resource appears to be an economically attractive and viable target for development. The U.S. Geological Survey (USGS) report titled "Assessment of Moderate- and High-Temperature Geothermal Resources of the United States" estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Arizona during the next 30 years at 26 MW, with a total low-high range of 4 MW to 70 MW (Williams et al. 2008). Arizona could experience increased interest in geothermal development,

particularly for indirect use. Depressed petroleum prices in the 1990s caused exploration expenditures to decline. As petroleum prices rise, exploration efforts for oil and gas will likely increase.

Locatable Minerals

The General Mining Law of 1872, as amended, opened the public lands of the United States to mineral acquisition by the location and maintenance of mining claims. Mineral deposits subject to acquisition in this manner are generally referred to as "locatable minerals." Locatable minerals include both metallic minerals (e.g., gold, silver, lead, copper, zinc, and nickel) and nonmetallic minerals (e.g., fluorspar, mica, certain limestones and gypsum, tantalum, heavy minerals in placer form, and gemstones).

The planning area has several designated metallic mineral districts that were delineated according to geologic criteria (age and style of mineralization) in 1983 (Keith et al. 1983) (**Figure 3-5**, Metallic Mineral Districts).

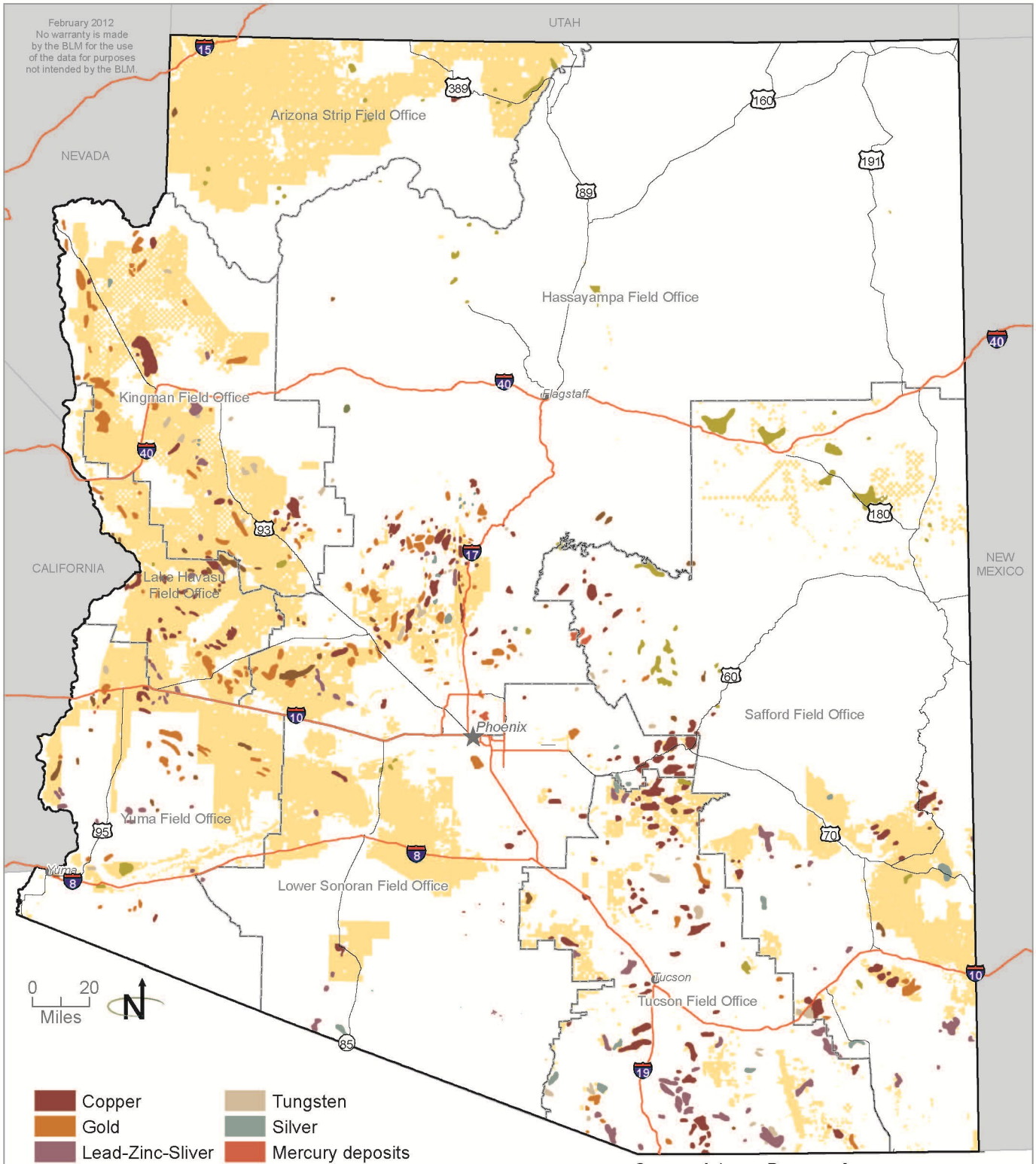
A statewide high occurrence of metallic minerals data layer was developed in 1993 (Bureau of Mines 1993) (**Figure 3-6**, High Potential for Known Mineral Deposits). There are approximately 1.1 million acres with high potential for known mineral deposits in the planning area, 395,100 acres of which are on BLM-administered lands.

In conjunction with **Figure 3-5**, Metallic Mineral Districts, **Table 3-5**, Metallic Mineral Districts in the Planning Area, illustrates the wide variety of metallic minerals in the planning area. There are 646 mineral districts in the planning area, which cover more than 1.7 million acres. Of those, 226 mineral districts are on BLM-administered lands and cover approximately 402,600 acres.

The most prevalent mineral type in the planning area and on BLM lands is "gold with or without copper or lead" followed by "copper." Combined, these two mineral types make up 47 percent of the planning area (50 percent of the BLM-administered lands). Currently, there is limited activity related to gold mining and prospecting on BLM-administered lands. According to BLM's LR2000 database, as of October 31, 2011, there are six authorized gold mining operations on BLM-administered lands (BLM 2011k). As illustrated by **Figure 3-5**, Metallic Mineral Districts and **Figure 3-6**, High Potential for Known Mineral Deposits, there is a northwest-trending belt of metallic mineralization that spans the entire state. The southeastern part of this belt is dominated by porphyry copper and associated lead, zinc, gold, and silver deposits. These deposits are associated largely with granitic rocks that were intruded 70 to 55 million years ago. Many important deposits in central Arizona are associated with Precambrian (1,750 to 1,650 million years ago) volcanic activity. The western end of the belt is dominated by gold deposits, mostly related to volcanic activity between 25 and 15 million years ago. In addition, economically significant uranium deposits are concentrated in the northern and northeastern portions of Arizona.

Metallic Mineral Districts

Metallic minerals are locatable minerals. Metallic mineral districts were delineated according to geologic criteria (age and style of mineralization).

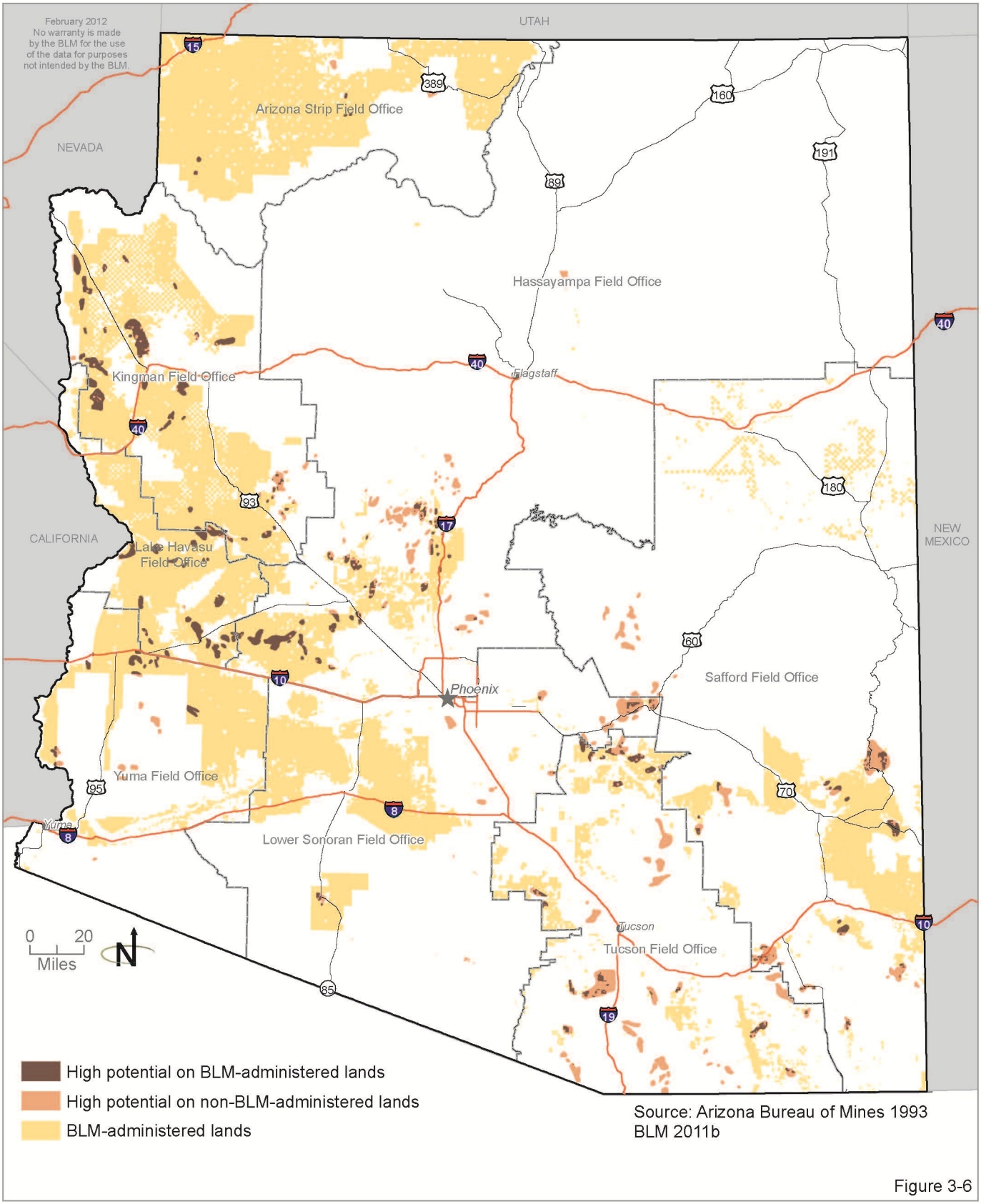


Source: Arizona Bureau of Geology and Mineral Technology 1983, (original map may be ordered from Arizona Geological Survey), BLM 2011b

Figure 3-5

High Potential for Known Mineral Deposits

Mineral deposit areas for locatable minerals include metallic and nonmetallic minerals.



Source: Arizona Bureau of Mines 1993
BLM 2011b

Figure 3-6

Table 3-5
Metallic Mineral Districts in the Planning Area

Metallic Mineral Type	No. of Mineral Districts in the Planning Area	Planning Area Acres	No. of Mineral Districts on BLM Land	BLM Acres
Copper	114	417,300	59	101,800
Copper, Gold, and Silver with or without Zinc. Stratabound volcanogene massive sulfide	28	42,400	16	14,100
Copper with or without Gold or Lead; veins	58	137,000	35	73,800
Gold with or without Copper or Lead	153	396,400	96	192,200
Iron, stratabound and contact metasonatic	2	3,000	--	--
Lead-Zinc-Silver veins and replacements	77	245,100	39	58,400
Manganese	49	91,200	28	55,400
Mercury deposits	6	16,300	1	300
Silver with or without Lead and Zinc; veins and replacements	31	70,000	13	21,000
Taconite-like Iron formations, Maricopa and Yavapai Counties	16	6,500	4	2,100
Tungsten; skarn and veins or pegmatites with or without Beryllium or Lithium	44	90,300	21	29,400
Unclassified (altered zones, no production)	5	6,900	2	1,200
Uranium with or without Vanadium	63	206,900	22	42,600
Total	**646**	**1,729,300**	**336**	**592,300**

Source: Arizona Bureau of Geology and Mineral Technology 1983

Copper

Arizona leads the nation in copper production. As of 2008, Arizona was producing over 60 percent of the United States' newly mined copper. Domestic production in 2007 was worth 5.5 billion dollars (Singh 2008). By-products of mining porphyry copper deposits have also been significant, accounting for a large percentage of Arizona's gold, silver, and molybdenum production.

In Arizona, most copper mining occurs in the southeast portion of the planning area. While most mine cores are located on private land, the fringes usually overlap federal and state lands. It is reasonable to assume that most copper mines in the planning area include a portion of BLM-administered lands.

Uranium

In the late 1940s and early 1950s, uranium was discovered in association with many of the old copper mines in the Grand Canyon region in geologic features called breccia pipes. Today, some of the highest grade uranium ore in this country is believed to be located in the many mineralized breccia pipes scattered across the Grand Canyon region (Alpine 2010). Many of these breccia pipes are on BLM-administered land, making this mineral noteworthy of discussion.

The Arizona 1 uranium mine resumed operation in 2009 after being in stand-by status for more than 20 years. The Arizona 1 mine is located on BLM-administered land within the BLM's Arizona Strip Field Office (Mohave County), about 45 miles southwest of Fredonia and 10 miles from the boundary of Grand Canyon National Park. The deposit is located within a 1,500-foot-deep breccia pipe. It contains uranium ore below the ground, along with various rock layers (Cole 2010). The uranium in this mine is estimated to be mined out in 2012. There are two additional mines on the Arizona Strip where mining activities are scheduled to resume in the near future.

On July 21, 2009, the Department of the Interior published notice of the Secretary's proposal to withdrawal approximately one million acres of federal locatable minerals in northern Arizona (near the Grand Canyon) from location of new mining claims and entry under the Mining Law. Publication of this notice segregated the land from location of new mining claims under the Mining Law for two years while studies were being completed (including an EIS) to provide information to the Secretary on whether it is necessary to withdraw some, all, or none of the segregation area for up to 20 years to protect the area from the potential adverse effects of mineral exploration and development.

The lands that were analyzed are contained in three parcels: two parcels on BLM-administered land to the north of the Grand Canyon (including the area containing the Arizona 1 uranium mine) and one on the Kaibab National Forest south of the Grand Canyon. The segregation expired on July 21, 2011, and the Secretary immediately implemented a six-month emergency withdrawal of these same lands to allow completion of the Northern Arizona Proposed Withdrawal EIS process. The Final EIS was published on October 28, 2011.

Additional uranium deposits are located in northeastern Arizona, but these deposits are on the Navajo Reservation, which is outside of the project planning area and therefore not discussed further.

Non-Metallic Minerals

Occurrences and prospects of non-metallic locatable minerals in the planning area are extensive. Arizona is known for its turquoise and peridot. Other non-metallic locatable minerals include limestone, feldspar, dolostone, gypsum, mica, perlite, and zeolite. Uncommon varieties of mineral materials in the planning

area such as pumice, rock, and cinders are also regulated as locatable minerals[1]. A statewide map of non-metallic locatable minerals is currently unavailable.

Rights to locatable minerals are obtained by filing a mining claim. According to BLM's LR2000 database, as of October 31, 2011, there are 45,298 active mining claims in Arizona. Of this total, 34,102 mining claims are on BLM-administered lands (BLM 2011k).

Continued strong demand and high prices for copper are driving exploration and development activity to the highest level in many years (Singh 2008). Byproducts of mining porphyry copper deposits also continues to be significant, accounting for all of Arizona's gold, silver, and molybdenum production (Singh 2008). It is anticipated that this trend will continue as long as the price of copper continues to increase.

Locatable Minerals Summary

Due to a rebound in prices, uranium mining has recently resumed in northern Arizona after a hiatus of more than 20 years (Cole 2010). On BLM-administered lands in Arizona, the future of uranium mining will largely be determined by the Secretary's decision on the Northern Arizona Proposed Withdrawal EIS.

Mineral Materials

Mineral materials are some of our most basic natural resources, such as sand, gravel, dirt, and rock, and are used in everyday building and other construction uses. Arizona ranks first in the United States for pumice and pumicite and second in reserves of construction-grade sand and gravel (AZGS 2011). Other mineral materials common in the planning area include clays, perlite, cement, and crushed stone.

Generally, salable minerals are widespread, of low unit value, and often used for construction or landscaping materials. Their value depends largely on market factors, quality of the material, availability of transportation, and transportation costs. Extraction of salable minerals from public land requires either a sales contract or a free-use permit. Salable minerals are sold at the resource's appraised fair-market value. Under a free-use permit, salable minerals may be provided at no cost to government agencies for use in public projects. The locations of known occurrences and prospects for salable minerals in the planning area are too numerous to discuss on an individual basis.

The salable mineral industry is strongly influenced by population and industrial growth and the condition of the economy. The current demand for salable minerals in Arizona is primarily to supply the construction market. This trend is

[1]A determination that a variety is "uncommon" and subject to the General Mining Law is made by BLM on a case-by-case basis.

expected to continue, particularly in expanding urban areas that place demands on materials such as sand, gravel, and decorative rock.

3.5.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located within the BLM's Yuma Field Office boundary. As such, this section is largely based on data from the Yuma Field Office RMP, approved in 2010 (BLM 2010g).

Leasable Minerals

The proposed Agua Caliente SEZ is in an area with less than moderate potential for oil and gas. There are no documented proven oil and gas reserves in the proposed Agua Caliente SEZ, and there has been only minor leasing interest in the surrounding BLM Yuma Field Office (BLM 2010g).

The proposed Agua Caliente SEZ is within the geothermal potential area as identified by the BLM Geothermal Leasing PEIS (BLM 2008b); however, no high or moderate temperature geothermal resources exist in the proposed Agua Caliente SEZ. There are no geothermal leases within the proposed Agua Caliente SEZ.

There are no known occurrences or prospects for coal, carbon dioxide/helium, potash, sulfur, or sodium resources within the proposed Agua Caliente SEZ.

Locatable Minerals

There are no metallic mineral districts within the proposed Agua Caliente SEZ, and it is not within an area identified as having high potential for mineral occurrence. According to BLM's LR2000 database, as of November 1, 2011, there are no active mining claims within the proposed Agua Caliente SEZ, nor are there any active mines (BLM 2011L). The LR2000 database indicates that historically some mining claims have been located in the general area. However, there does not appear to have been related mining or exploration activities related to these mining claims. These claims are no longer active, and the commodities found on the claims were not recorded.

Mineral Material

The proposed Agua Caliente SEZ is in an area open for the disposal of salable minerals and is designated as having moderate potential for salable minerals, including sand, gravel, aggregate, cinders, decorative rock, and building stones (BLM 2010g). The locations of known occurrences and prospects for salable minerals in this area are too numerous to discuss on an individual basis.

3.6 FISH AND WILDLIFE

The various ecoregions encompassed by the study area include a wide range of habitats that support a high diversity of terrestrial wildlife species and aquatic biota (AZGFD 2006). Further details on ecoregions are included in **Section 3.21**, Vegetation. Species present at a particular location will depend upon the plant communities and habitats present; further analysis of fish and wildlife

species would be conducted at the project-specific level prior to site development.

3.6.1 RDEP Affected Environment

The BLM has active wildlife management programs within each field and district office. Wildlife management programs are largely aimed at habitat protection and improvement. The general objectives of wildlife management are to maintain, improve, or enhance wildlife species diversity while ensuring healthy ecosystems, and to restore disturbed or altered habitat with the objective of obtaining desired native plant communities, while providing for wildlife needs and soil and hydrologic stability. The BLM is primarily responsible for managing habitats, while the AZGFD has the responsibility for managing the big game, small game, and nongame fish and wildlife species in cooperation with the BLM. AZGFD has developed management plans and conservation strategies for game and non-game species in the state. The AZGFD has defined conservation potential areas in the state; the department vision for critical habitat areas is to preserve these areas and interconnected networks between them to support viable populations of wildlife, while providing ample opportunity for people to enjoy and benefit from the presence of wildlife (**Figure 3-7**, Arizona Game and Fish Department Species and Habitat Conservation Guide Conservation Potential). The conservation potential areas were determined by utilizing a model assessing five indicators of wildlife conservation value:

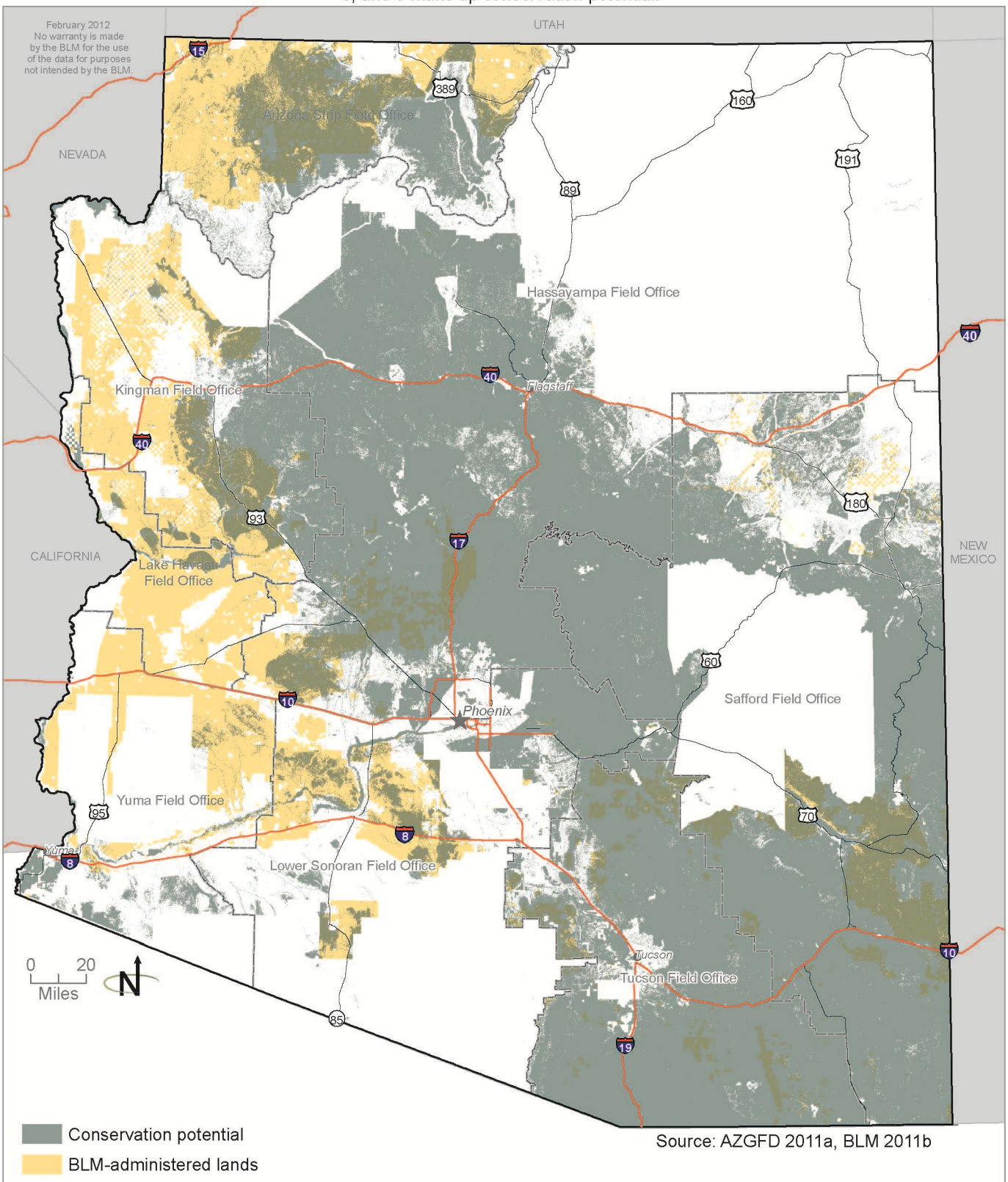
1. The importance of the landscape in maintaining biodiversity, represented by the Species of Greatest Conservation Need.
2. The economic importance of the landscape to the AZGFD and the community, represented by the Species of Economic and Recreational Importance.
3. The economic importance of the water bodies and aquatic systems to the AZGFD and the community, represented by sportfish.
4. Large areas of relatively intact habitats, represented by unfragmented areas.
5. The importance of riparian habitat to wildlife, represented by riparian habitat.

Wildlife corridor information also will be added to the model as it becomes available. For any given area, each indicator was given a score from one to ten and combined in the conservation potential model. The resulting gradient was reclassified to six classes based on qualities, with Class 1 indicating the lowest conservation potential, and Class 6 indicating the highest conservation potential.

State statutes provide protection for wildlife, including the Arizona Revised Statute, Title 17, which protects all of Arizona's native species. The USFWS has oversight of migratory bird species, bald and golden eagles, and all federally

Arizona Game and Fish Department
Species and Habitat Conservation Guide Conservation Potential

AZGFD Species and Habitat Conservation Guide tiers 4, 5, and 6 make up conservation potential.



Source: AZGFD 2011a, BLM 2011b

Figure 3-7

threatened, endangered, proposed, or candidate species as discussed in **Section 3.19**, Special Status Species. The following discussions present general descriptions of the fish and wildlife species and special categories of species that may occur in the planning area.

Fish

A total of 36 fish species are native to Arizona and are found in the Colorado River, Gila River, and their tributaries and in springs. Some native species are adapted to the desert environment with an ability to adjust to periods of drought and flash floods. In addition, many of the native species that occur are specially adapted to local conditions and are endemic (i.e., native to a certain locality or system).

The majority of Arizona lies within the Lower Colorado River hydrologic region, with the exception of a small portion of the northeast corner of the state, north of Lees Ferry, which falls within the Upper Colorado hydrologic region. The Colorado and Gila Rivers comprise the major drainages within the Upper Colorado hydrologic region. The native fish community within the Lower Colorado River hydrologic region is dominated by fishes within the minnow and sucker families. The Lower Colorado River was historically a warm, turbid, and swift river. Construction of dams and reservoirs within the region has now altered habitat conditions and changed flow regimes by creating a series of cold, clear impoundments. These changes, along with the introduction of nonnative fishes and a variety of other habitat changes due to development, have resulted in declines in native fish populations throughout much of the Lower Colorado River Basin. In 1994, the USFWS designated critical habitat for four endangered fishes within the Colorado River Basin (bonytail chub [*Gila elegans*], razorback sucker [*Xyrauchen texanus*], humpback chub [*Gila cypha*], and Colorado River pikeminnow [*Ptychocheilus lucius*] (Lower Colorado River Multi-Species Conservation Program 2004). The Gila River drainage provides habitat for the following species: loach minnow (*Tiaroga cobitis*), spikedace (*Meda fulgida*), gila topminnow (*Poeciliopsis occidentalisoccidentalis*), Gila trout (*Oncorhynchus gilae gilae*), and Apache trout (*Oncorhynchusgilae apache*). These species are discussed in **Section 3.19**, Special Status Species. In the planning area as a whole, one species (Santa Cruz Pupfish [*Cyprinidon arcuatus*]) is already extinct, 34 have been identified as Species of Greatest Conservation Need by the AZGFD, and 20 have been federally listed as endangered or threatened (AZGFD 2011b).

Sport fishing opportunities in Arizona include more than 1,500 miles of stream and around 80 lakes that are managed for trout. Warmwater fishing opportunities include about 355,000 acres of impounded water (lakes, reservoirs, ponds, and tanks) and 35,840 acres of flowing water. There are approximately 27 species commonly sought by Arizona anglers: eight are cool or coldwater fish, and 19 are warm-water species. Today, sport fish management involves many activities, including monitoring, research, stocking, habitat improvement, evaluation, information, and education (AZGFD 2011b).

Impoundments, water diversions, changes in water quality, and predation by and competition with nonnative fishes have led to population decreases in native fish. Native fish management is therefore a priority in the state and includes on-the-ground conservation projects, threatened and endangered species recovery, statewide population monitoring, creation and implementation of conservation agreements, provision of research grants, and public education and outreach. Current strategies are moving away from management for individual non-game or game species and moving towards a watershed approach, managing at the ecosystem level.

Birds

The Migratory Bird Treaty Act of 1918, as amended (MBTA) (16 USC §§ 703-712) makes it unlawful to, among other things, pursue, hunt, take, capture, kill, or possess any migratory bird or part, nest, or egg of such bird listed in four separate wildlife protection treaties between the U.S. and Great Britain (on behalf of itself and Canada), Mexico, Japan, and the former Union of Soviet Socialist Republics. The MBTA currently covers 1,007 species, as specified in 50 CFR Section 10.13.

A total of 534 species of birds have been documented in Arizona. Approximately 300 species have been documented as breeding in the state. Seven nonnative species have, through the actions of humans, become established in the state (AZGFD 2011b). Details for important groups of birds and bird areas are described below.

Important Bird Areas

Important bird areas are locations that provide essential habitats for breeding, wintering, or migrating birds. While these sites can vary in size, they are discrete areas that stand out from the surrounding landscapes. Important bird areas must support one or more of the following:

- Species of conservation concern (e.g., threatened or endangered species);
- Species with restricted ranges;
- Species that are vulnerable because their populations are concentrated into one general habitat type or ecosystem; or
- Species or groups of similar species (e.g., waterfowl or shorebirds) that are vulnerable because they congregate in high densities.

The important bird area program has become a key component of many bird conservation efforts. Within the planning area, a number of important bird areas have been identified by the Audubon Society. These include 5 important bird areas of global significance (537,600 acres) and 35 of state significance (3,141,500 acres) (Arizona Audubon 2011).

Migratory Birds

Many of the bird species in the planning area are migratory seasonal residents. These birds include waterfowl, shorebirds, raptors, and neotropical songbirds. The USFWS has the legal mandate and the trust responsibility to maintain healthy migratory bird populations. Federal regulations to protect the migratory birds include the MBTA and Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds. There is also a Memorandum of Understanding (MOU) between the BLM and USFWS to promote the conservation of migratory birds. The purpose of the MOU is to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds through enhanced collaboration between the two agencies, in coordination with state, tribal, and local governments. The USFWS has also outlined a plan to conserve and protect migratory birds in its Migratory Bird Strategic Plan 2004-2014. The strategy includes direct collaboration with the BLM in making land use and planning decisions (USFWS 2004).

Waterfowl, Wading Birds, and Shorebirds

Waterfowl (geese, ducks, teal, etc.), wading birds (herons and cranes), and shorebirds (plovers, sandpipers, and similar birds) are found throughout the planning area. Within the region, migration routes for these birds are often associated with riparian corridors and wetland or lake stopover areas. Some notable areas in the state include lakes and reservoirs in the White Mountains, Cibola National Wildlife Refuge, Roosevelt Lake, Whitewater Draw Wildlife Area, Anderson Mesa wetlands, and areas on the Gila River (AZGFD 2011b). Some waterfowl species are game species and are hunted throughout the planning area. Notable species of birds hunted in the planning area include sandhill crane (*Grus canadensis*), Canada goose (*Branta canadensis*), and mallard (*Anas platyrhynchos*), as well as numerous other duck and teal species.

Neotropical Migrants

Arizona is home to many species of neotropical migrants, bird species that breed in the U.S. and Canada and winter primarily from Mexico to South America. For many of these migrants, Arizona serves as a migration corridor between the northern breeding grounds and the southern wintering areas. In total, 237 neotropical migrant species have been documented in Arizona, of which 163 species have been documented as nesting in the state (AZGFD 2011b).

Birds of Prey

Birds of prey include raptors, owls, and vultures. The largest of these birds are the premier avian predators in their respective ecosystems. Forty-four raptor species have been documented in Arizona, including various species of hawks, falcons, and kites as well as osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), and golden eagle (*Aquila chrysaetos*). A total of 37 of the raptor species are known to breed in the state. Four species are federally listed as

threatened or endangered (AZGFD 2011b). Special status species are included in **Section 3.19**, Special Status Species. Raptors forage on a variety of prey, including small mammals, reptiles, other birds, fish, invertebrates, and, at times, carrion. Hunting and foraging varies significantly among species, with some being very active hunters, pursuing prey on the wing, and others foraging from a perch; all forage during the day.

Owls in Arizona are represented by 13 species, notably the burrowing owl (*Athene cunicularia*), ferruginous pygmy-owl (*Glaucidium brasilianum*), flammulated owl (*Otus flammeolus*), and Mexican spotted owl (*Strix occidentalis lucida*) (AZGFD 2011b). These species are found throughout the planning area in a variety of ecosystems. Vultures are represented by three species: the endangered California condor (*Gymnogyps californianus*), black vulture (*Coragyps atratus*), and turkey vulture (*Cathartes aura*). These birds are large soaring scavengers that feed on carrion. The California condor has been reintroduced to the Vermilion Cliffs in northern Arizona under Section 10(j) of the Endangered Species Act (ESA) as an experimental non-essential population.

Special protection is provided for some birds of prey species. The Arizona population of bald eagles was removed from ESA listing in February 2010 (Federal Register 2010); however, bald and golden eagles are still protected under the Bald and Golden Eagle Protection Act (16 USC 668–668d, 54 Stat. 250, as amended), which prohibits the taking or possession of, or commerce in, bald and golden eagles, with limited exceptions for permitted scientific research and Native American religious purposes. The 1978 amendment authorizes the Secretary of the Interior to permit the taking of golden eagle nests that interfere with resource development or recovery operations. Recent guidance has also been developed to guide wind energy development. The Guidance for Reducing Impacts to Wildlife from Wind Energy Development (AZGFD 2009) and USFWS Draft Land-Based Wind Energy Guidelines (USFWS 2011a) aim to help industry avoid and minimize impacts on federally protected migratory birds and bats and other impacted wildlife resulting from site selection, construction, operation, and maintenance of wind energy facilities. The Draft Eagle Conservation Plan Guidance (USFWS 2011b) provides information to aid in the evaluation of impacts from proposed wind energy projects to eagles protected by the Bald and Golden Eagle Protection Act and other federal laws. The BLM field or district offices also have specific management guidelines for raptors.

Upland Game Birds and Migratory Game Birds

Game birds that are native to the planning area include the blue grouse (*Dendragapus obscurus*), wild turkey (*Meleagris gallopavo*), Gambel's quail (*Callipepla gambelii*), scaled quail (*C. squamata*), and Mearns quail (*Cytonyx Montezuma*). Introduced species managed as game species include the ring-necked pheasant (*Phasianus colchicus*) and chukar (*Alectoris chukar*). All of the upland game bird species are year-round residents. Migratory game birds in Arizona include ducks, geese, swan, coots, gallinules, the sandhill crane, common

snipe (*Gallinago gallinago*), mourning dove (*Zenaida macroura*), white-winged dove (*Z. asiatica*), and band-tailed pigeon (*Columba fasciata*) (AZGFD 2011b). The determining factor controlling small game numbers in Arizona is the quality and quantity of habitats, which vary by location and season.

Declines in many bird populations in Arizona and across the nation have led to concern about the future of migratory and resident birds. The reasons for the declines are complex but include loss and fragmentation of the birds' habitat where they breed, winter, and migrate. Arizona Bird Conservation Initiative and other organizations are working with AZGFD to monitor bird populations and create conservation initiatives to protect bird species (Arizona Partners in Flight 1999).

Mammals

A total of 134 native and 11 introduced mammals have been documented in Arizona (AZGFD 2011b). Many nongame mammals in Arizona are poorly known; among those in need of additional information and field study are the water shrew (*Sorex palustris*), jumping mouse (*Zapus hudsonius*), and several species of pocket mice. Thirty-four Arizona mammals are identified as Species of Greatest Conservation Need, and nine are also federally listed as endangered under the ESA. Further information is included in **Section 3.19**, Special Status Species. Most imperiled species have very small, local populations that face a variety of threats. Some species are tied to riparian or native grassland habitats.

The AZGFD manages game mammals and establishes seasons, season dates, and permit numbers. They also define the times and methods of taking wildlife and the possession and bag limits. A number of the big game species make seasonal migrations when seasonal changes reduce food availability, or where local conditions are not suitable for calving or fawning. Large game mammals and trends for each species are discussed below, and important big game habitat as determined by AZGFD is shown on **Figure 3-8**, Important Big Game Habitat.

Pronghorn

Pronghorn are native to the prairies of North America. In Arizona, pronghorn are found primarily in the northern plains. They also inhabit high elevation meadows between forested areas and semi-desert grasslands, and scattered herds are found in the grasslands of southeastern Arizona. The species is secure in Arizona (NatureServe 2011). The endangered Sonoran pronghorn occurs in Mexico and southwestern Arizona (AZGFD 2011b). Pronghorn are found in mixed herds most of the year, except in the spring when the bucks are alone or in small groups. In the fall, bucks collect harems up to 15 to 20 does, which they then defend from other bucks. Pronghorn breed in August and September and the young are born in May and June. Preferred food includes grasses, weeds, cacti, juniper, winterfat, and chamise. In 1922, the state's pronghorn population

Important Big Game Habitat

Important big game habitat was determined utilizing Arizona Game and Fish Department big game species density data. The data for the following species were determined as important: elk summer habitat, elk winter habitat, bighorn sheep, black bear, javelina, mountain lion high, mule deer summer and winter habitat, turkey summer and winter, and white-tailed deer.

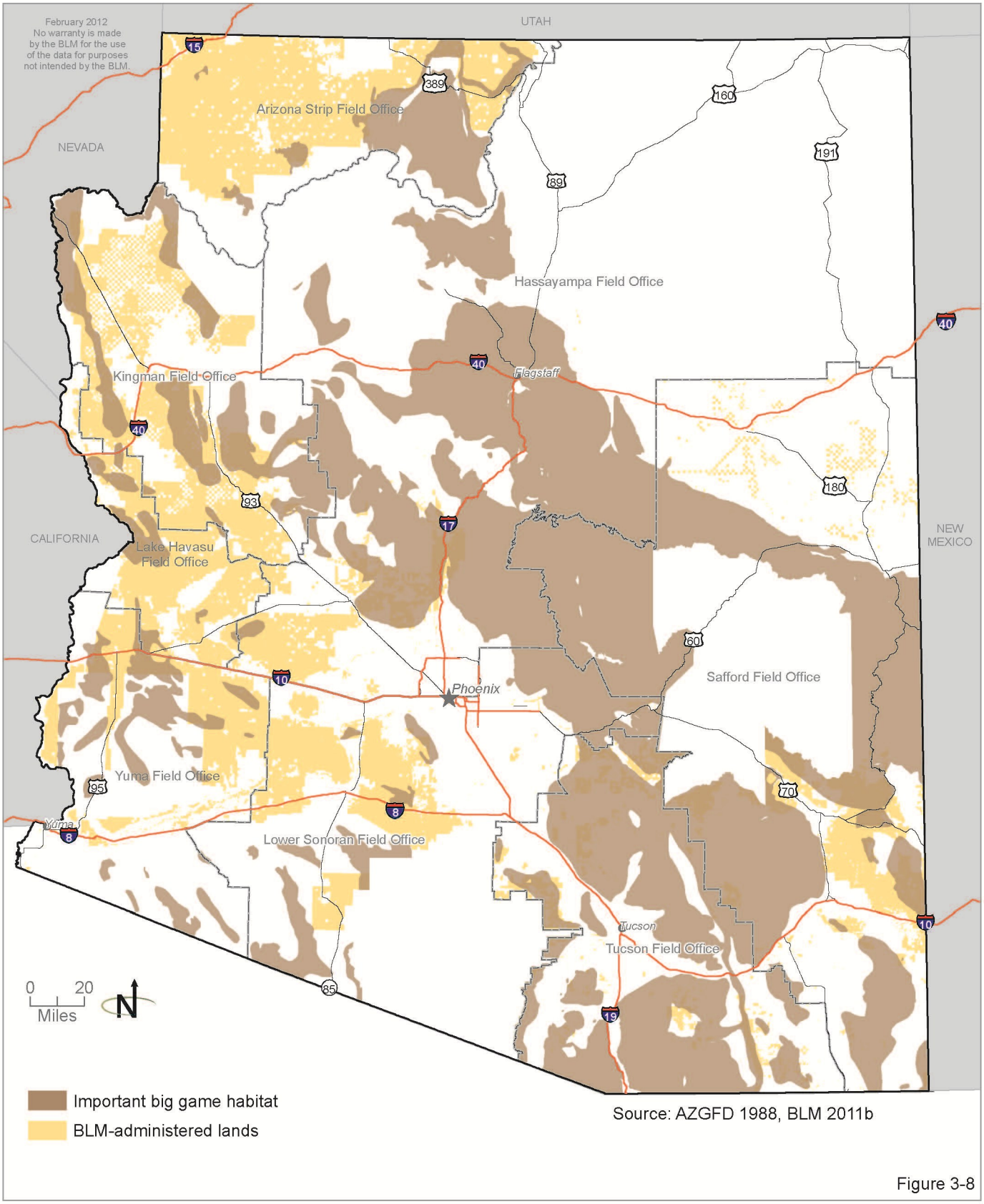


Figure 3-8

was estimated to be less than 1,000 animals. Aided by a closed hunting season, government predator control programs, and the abandonment of numerous homesteads, pronghorn numbers steadily increased and hunting was opened in 1949. Today, due to loss of habitat from housing development, fragmentation by highways, and other land use changes, populations have declined and are maintained by relocation programs. Approximately 10 percent of the pronghorn harvest is in areas having reintroduced herds (AZGFD 2011b).

Black Bear

In Arizona, the black bear is found in most woodland habitats, including pinyon-juniper, oak woodland, coniferous forest, and chaparral, from approximately 4,000 to 10,000 feet. The species is considered secure in Arizona (NatureServe 2011); however, there is no sizeable population of black bears north of the Colorado River. Cubs are born during the winter and emerge from the den in April and stay with their mother through their first summer and fall. Normal reproductive cycles of Arizona black bears may be adversely affected by drought and resultant poor physiological condition. The low reproductive potential of this species is becoming an increasingly important management consideration. Concerns about the bear's relatively low reproductive rate have recently caused the AZGFD to monitor the bear harvest more closely and implement additional regulations (AZGFD 2011b).

Bighorn Sheep

Arizona's bighorn sheep population, consisting of both desert and Rocky Mountain subspecies, is estimated at 6,000 animals, reduced from historic numbers due to competition with livestock for food and water and exposure to livestock-associated parasites and diseases. Bighorn sheep were not legal game in Arizona until 1953. Since then, permit numbers, the number of units open to hunting, the number of rams taken, and hunt success have gradually increased. Bighorn sheep are social animals. Mature rams stay in one group while the ewes, lambs, and young rams congregate separately. The groups join during the rut (mid-November through late December) and occasionally in the spring when plants are abundant. Bighorn eat native grasses and also feed heavily on jojoba. Pincushion and saguaro cactus provide moisture. Preferred plant species vary with habitat quality, locality, and species availability (NatureServe 2011).

Elk

Elk were at one time the most widely distributed member of the deer family in North America, found everywhere except the Great Basin desert and the Southern coastal plains. Population threats have included hunting to supply commercial markets, as well as agriculture. Following population lows in the 1920s, herds from Yellowstone National Park were transplanted throughout the West. In February 1913, 83 elk were released in Cabin Draw near Chevelon Creek. From these transplants, the Arizona elk population has grown to nearly 35,000 animals (AZGFD 2011b). Summer elk range is typically within a half mile of water in Arizona. Summer range varies in elevation from 7,000 feet in the

mixed conifers to 10,000 feet in the spruce fir-subalpine belt. Winter range is often the limiting factor for elk herds, as only about 10 percent of their total habitat is winter range. Winter range varies in elevation from 5,500 to 6,500 feet in Arizona, in the pinyon-juniper zone (NatureServe 2011).

Javelina

The collared peccary, or javelina, evolved in South America and migrated north, only recently arriving in Arizona. The species is found between 1,000 to 6,000 feet in elevation in desert, chaparral, and oak-grasslands. Javelina are herd animals. Territories are set up and defended. Territory size varies with the productivity of the habitat but averages about 750 acres (NatureServe 2011). Javelina were not legally designated as big game until 1929 in Arizona. Hunter interest has gradually increased, and javelina has become an important game animal in the past 50 years (AZGFD 2011b).

Mountain Lion

In Arizona, mountain lions are absent only from the areas heavily impacted by human development. In general, the distribution of mountain lions in Arizona corresponds with the distribution of its major prey species, deer. Mountain lions are very specialized top predators and consequently do not normally exist in high concentrations. Preferred prey includes deer, elk, javelina, and bighorn sheep (NatureServe 2011). Lions were classified as a "predatory animal" and were subject to a statewide bounty until 1970 (AZGFD 2011b).

Mule Deer

The most abundant deer in Arizona is the Rocky Mountain mule deer. Mule deer are not limited to any one type of terrain, being found from sparse, low deserts to high forested mountains. Desert mule deer also occur in Arizona, though in fewer numbers. It is slightly smaller, paler in color, and with a smaller rump patch. Today, mule deer comprise about 60 percent of the total deer harvested (AZGFD 2011b). Population cycles are linked to variations in climate and precipitation. Recent years with above average winter precipitation have created improved conditions for mule deer. Deer feed on grasses and forbs in the spring and summer; however, they are primarily browsers. They eat such items as twigs, bark, buds, leaves, and nuts. Important plants in a mule deer's diet include mountain-mahogany, buckbrush, cliffrose, sagebrush, buckthorn, juniper, and oak (NatureServe 2011). Home range size may be 30 to 240 hectares or more and is directly correlated with availability of food, water, and cover. Desert mule deer have adapted to harsh conditions, such as extreme heat and cold, meager forage, scarce water, and lack of vegetative cover. In Arizona, predation on deer is mainly by coyotes, bobcats, and mountain lions.

Coues Deer

The Coues deer is a subspecies of the white-tailed deer. Coues deer are most common in Arizona's southeastern mountains but range up to the Mogollon Rim and into the White Mountains. They are most abundant in areas of

predictable summer precipitation. White-tailed deer occur in two social groups: 1) adult females and young, and 2) adult and occasionally yearling males, although adult males are generally solitary during the breeding season except when with females (NatureServe 2011). The annual home range of sedentary populations can average as much as 1,285 acres, while some populations can undertake annual migrations of up to 31 miles. They prefer woodlands of chaparral, oak, and pine with interspersed clearings and eat weeds, shrubs, mast, grass, mistletoe, and cacti fruits in season (NatureServe 2011). The subspecies has become increasingly important in the harvest. Today, they comprise over 40 percent of total deer harvested (AZGFD 2011b).

Reptiles/Amphibians

Arizona supports 107 species of native reptiles, including 6 turtle species, 49 lizard species, and 52 species of snakes (AZGFD 2011b). Among the snakes are 13 species of rattlesnakes, which is just over one-third of the world's rattlesnakes. Eleven of the reptile species are protected in the state and are illegal to collect from the wild. In addition to the native reptiles, six nonnative species have become established in the state. Reptiles are found throughout the state, occurring in all of Arizona's vegetative communities.

A total of 25 species of native amphibians, including 24 species of frogs or toads and 1 salamander species (tiger salamander [*Ambystoma tigrinum*]) are found in Arizona (AZGFD 2011b). Amphibians in the planning area are found not only in riparian and aquatic environments but also in desert ecosystems, where they spend much of their lives buried underground only to emerge briefly to breed and grow during the summer rains. Habitat changes due to demand for water in the state have led to increased pressure on many species. In addition to the 25 species of native amphibians, Arizona has 4 species of exotic amphibians: bullfrog (*Lithobates catesbeiana*), Rio Grande leopard frogs (*Lithobates berlandieri*), African clawed frogs (*Xenopus laevis*), and barred tiger salamanders (*Ambystoma mavortium*). Amphibian and reptile species that have special status listing are addressed in **Section 3.19**, Special Status Species.

3.6.2 Agua Caliente Solar Energy Zone Affected Environment

Fish and Wildlife

The proposed SEZ is within the Sonoran Desert ecoregion, dominated by Lower Sonoran desert scrub vegetation. Wildlife in the proposed SEZ are likely typical of those species that use this habitat type. Common species within the Lower Sonoran desert scrub habitat include zebra-tailed lizard (*Callisaurus draconoides*), desert mule deer (*Odocoileus hemionus crooki*), round-tailed ground squirrel (*Spermophilus tereticaudus*), desert cottontail (*Sylvilagus auduboni*), pocket mouse (*Perognathus* spp.), red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), swallows (*Hirundo* spp.), rattlesnakes (*Crotalus* spp.), and desert iguana (*Dipsosaurus dorsalis*). AZGFD conservation potential areas are described above in **Section 3.6**, Fish and Wildlife. The proposed SEZ has lands

characterized as AZGFD conservation potential levels 1 through 5, but the majority of the area is categorized as level 1.

The proposed SEZ is within the Palomas Plain Wildlife Habitat Area (WHA) identified by the Yuma RMP. **Figure 3-9**, Important Resources in Proposed Agua Caliente SEZ, is a map of conservation potential levels. This WHA is the largest unfragmented habitat in southwest Arizona for a myriad of wildlife, including bighorn sheep and mule deer. It contains braided channel floodplains and mixed cacti paloverde communities on rocky slopes and bajadas. The large, contiguous, unfragmented habitat is significant to the hunting community. This area is a potential reintroduction area for the endangered Sonoran pronghorn (BLM 2010g).

There are no perennial aquatic systems within the proposed SEZ, and thus aquatic species are not present. However, seasonally wet areas are present as evidenced by the braided channels throughout the proposed SEZ, and many species may use these for water sources.

Big Game

Mule deer and mountain lions occur in the proposed SEZ and may use the washes as movement corridors. The Yuma RMP acknowledges that the federally endangered Sonoran pronghorn (*Antilocapra americana sonoriensis*) could use the proposed SEZ and surrounding area, which has been identified as a potential reintroduction area for the species. An experimental population has been reintroduced in the Kofa National Wildlife Refuge to the west of the site. Pronghorn have not been recorded onsite, but given their large territory size and mobility, could use the site if the population expands.

Migratory Birds

Migratory birds could utilize the shrubs and leguminous trees within the proposed SEZ, particularly within the washes where there is ample cover for nesting and foraging. Species observed on site include turkey vulture, northern harrier (*Circus cyaneus*), Gambel's quail (*Callipepla gambelii*), and white-winged dove (*Zenaida asiatica*). Thrashers, sparrows, and an owl were observed, though not identified to species.

Wildlife populations in the proposed SEZ are likely stable given the relatively rural and undisturbed nature of the site. The current adjacent solar development could be displacing or disturbing wildlife in and around that area, causing more wildlife to move away from the area, or to inhabit the proposed SEZ site for refuge. The proposed SEZ is a popular area for mule deer hunting.

Important Resources in Proposed Agua Caliente SEZ

The proposed Agua Caliente SEZ is scoured by braided series of washes and ephemeral streams. A small amount of Tortoise Category 3 is within the proposed SEZ. The proposed SEZ is within the Palomas Plain Wildlife Habitat Management Area. The proposed SEZ is in AZGFD conservation potential tier 1, the lowest tier of potential, with the exception of the washes, which are tier 3.

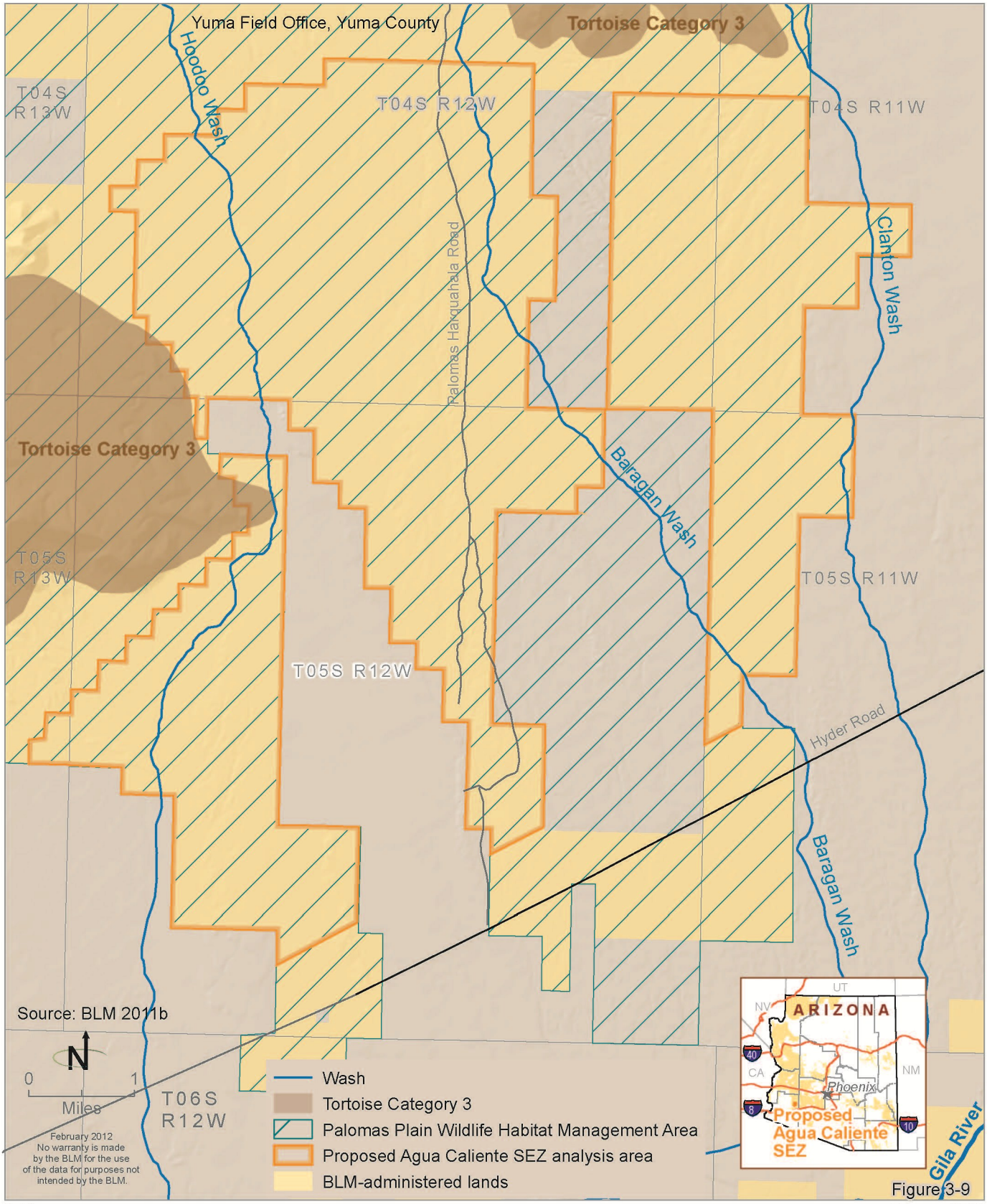


Figure 3-9

3.7 GEOLOGY AND SEISMICITY

3.7.1 RDEP Affected Environment

Physiography

The planning area lies within three distinct physiographic provinces, the Basin and Range, the Transition Zone (also referred to as the Central Highlands), and the Colorado Plateau (see **Figure 3-10**, Physiographic Provinces).

The Basin and Range Physiographic Province of southwestern North America includes southern and western Arizona and is characterized by numerous mountain ranges and intervening Cenozoic basins. The geology of these mountains is generally complex and variable. The Basin and Range Physiographic Province is characterized by nearly parallel mountain ranges that trend north to northwest and are separated by broad valleys filled with sediments. In Arizona, the Province is subdivided into a mountain region and a desert region occurring in the Sonoran Desert of southwest Arizona. The mountain region contains higher and wider mountains with less extensive alluvial valleys than does the desert region. The mountains of the Basin and Range Province represent blocks of rock bounded by near-vertical normal faults that were upthrown in late Tertiary times. The significance of relative age of each of these processes varies greatly from range to range (Spencer and Reynolds 1989). This area is characterized by irregular surfaces, northerly trending mountain ranges, sediment-filled basins, abundant igneous and metamorphic rock exposures, extensive faulting and folding, and widely exposed Precambrian rocks (see **Figure 3-11**, Surface Geology Age). The rocks consist mostly of Precambrian phyllites, schists, and gneisses; lower to mid-Paleozoic limestones and shales; and volcanic rocks from numerous ages, ranging from Precambrian through late Cenozoic. The geology of the valleys is poorly known because of their sediment cover.

Figure 3-10 Physiographic Provinces



The northern sections of the Basin and Range Province fall within the Central Highlands (also the southern extent of the Transition Zone, see below). The basins generally consist of surficial and sedimentary deposits. The mountain ranges consist of granitoid and metamorphic rock. The White Tank Mountains, Harquahala Mountains, and mountain ranges surrounding the town of Wickenburg are in the Basin and Range Province. The Bradshaw Mountains are within the Central Highlands region. Geologic faults in central Arizona are generally short, discontinuous, normal faults that date to the Quaternary Period, the last two million years. The Verde Fault, a potentially active fault, is located 25 miles northeast of Prescott near the town of Jerome. The only areas of concern for earthquake hazard within the planning area are at the moderate

Surface Geology Age

The Colorado Plateau Physiographic Province, shown in Figure 3-9, contains geologic units of a different age than those of the Basin and Range Physiographic Province.

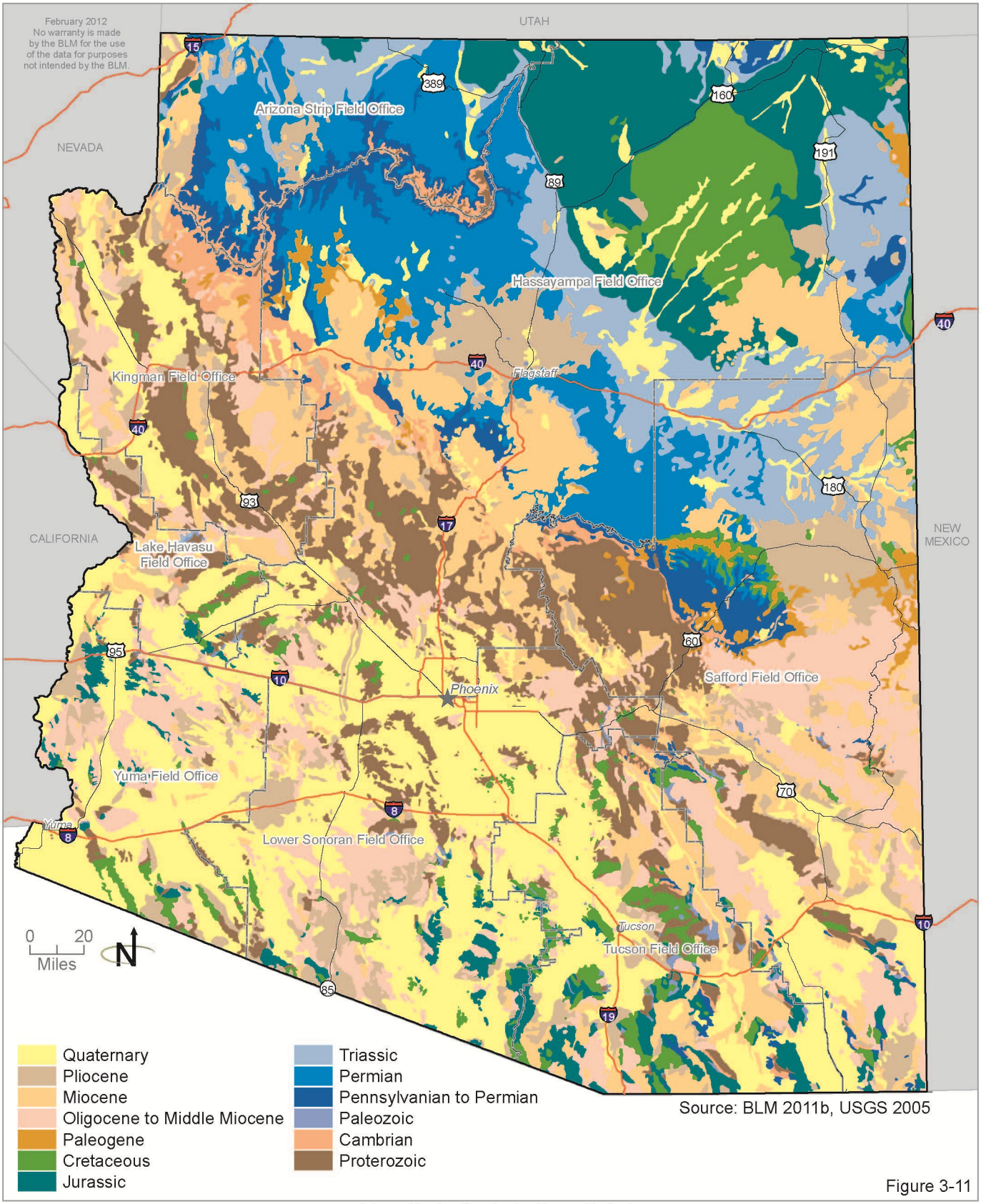


Figure 3-11

to low level for the northern portions near Prescott. The remainder of the planning area is in the low hazard level. The last known earthquake in central Arizona occurred near Constellation, Arizona in 1930 (BLM 2008a).

The Basin and Range Province of Arizona is bounded on the north and east by what is called the Transition Zone (BLM 1991). This area separates the Basin and Range Province in the southwestern part of the state from the Colorado Plateau Physiographic Province in the northern and northeastern part of the state. The Transition Zone is a northwest-trending escarpment of mountainous terrain in central Arizona shaped by the intersection of the higher-level Colorado Plateau with the lower-level Basin and Range Province. The area is termed the Transition Zone because it is transitional between the two regions, with characteristics of both. The area consists of a series of rugged mountain ranges and valleys. Many of the mountains of the Transition Zone are part of the Mogollon Rim, a cliff, or a dramatic escarpment in places, which extends 115 miles from northern Yavapai County eastward to near the border with New Mexico. The mountain ranges of the Transition Zone include the Mazatzal, Santa Maria, Sierra Ancha, and White Mountain ranges.

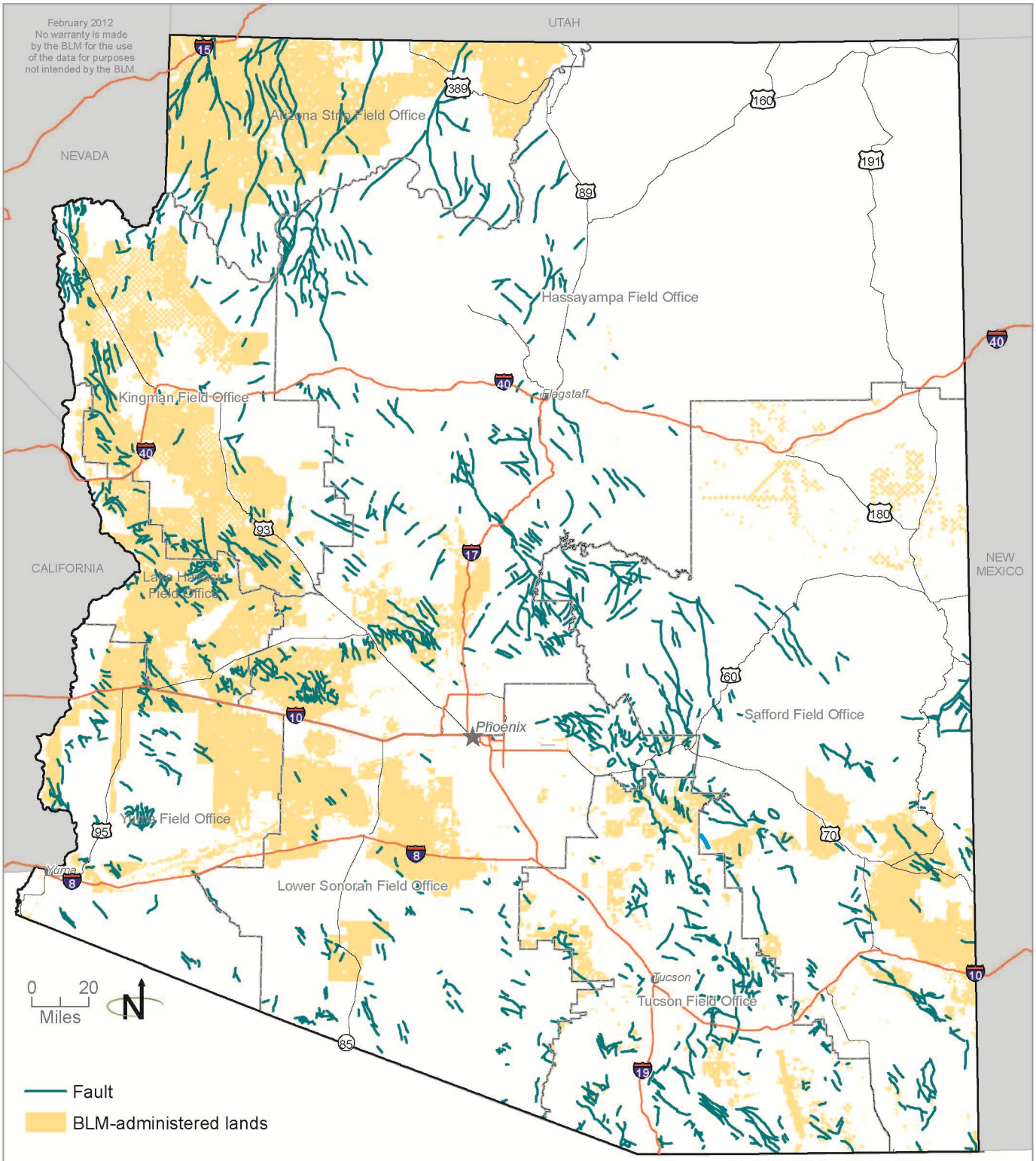
The Colorado Plateau of Arizona consists of a thick sequence of locally folded or faulted but generally flat-lying and undeformed, sedimentary rocks overlying a basement complex of granite and schist. Most of the rocks exposed are upper Paleozoic or Mesozoic age, predominantly sandstone or limestone (BLM 1995a, 2007a). The Grand Wash Cliffs Fault Zone east to Marble Canyon lies within the Colorado Plateau province. This province is characterized by predominantly sedimentary rock exposures; a regular, gently dipping surface; and plateau elevations exceeding 5,000 feet with subordinate plateaus exceeding 9,000 feet. The portion of the Colorado Plateau known as the Grand Canyon section is characterized by block plateaus over 7,000 feet in elevation, which have been cut up to 5,000-6,000 feet by the Colorado River and its tributaries.

Major structures that occur include faults (e.g., Virgin, Grand Wash Cliffs, Mainstreet, Hurricane, Dellenbaugh, Toroweap, Sevier, and Muav Canyon Faults; see **Figure 3-12**, Major Arizona Faults); anticlines (Vermilion, Kaibab, and Echo anticlines); and monoclines (Kaibab and Echo Cliffs monoclines). In general, northerly trending normal faults, downthrown to the west, dominate the structural setting of the western two-thirds of the planning area. East of the Muav Canyon Fault Zone, anticlines and monoclines are the most common major structural types.

Several minor plateaus have been defined in the Colorado Plateau province, including the Kaibab Plateau, Kanab Plateau, and the Uinkaret Plateau (BLM 2007b). In northwestern Arizona, Paleozoic rocks unconformably overlie the Precambrian through lower Cenozoic sediments of both continental and marine

Major Arizona Faults

In general, northerly trending normal faults, down thrown to the west, dominate the structural setting of the western two-thirds of the planning area.



Source: ALRIS 2010b, BLM 2011b

Figure 3-12

origin. In addition, Tertiary and Quaternary volcanic features overlie these sediments in the western half of the planning area.

Grand Canyon-Parashant National Monument encompasses the lower portion of the Shivwits Plateau, which forms an important watershed for the Colorado River and Grand Canyon. The plateau is bounded on the west by the Grand Wash Cliffs and on the east by the Hurricane Cliffs. These cliffs, formed by large faults slicing north to south through the region, are the major topographic barriers. At the southern end of the Shivwits Plateau are several important tributaries, including the rugged Parashant, Andrus, and Whitmore Canyons. Volcanic rocks with an array of cinder cones cap the plateau and basalt flows and range in age from 9 million to 1,000 years old. Lava from the Whitmore and Toroweap areas has flowed into the Grand Canyon and dammed the river many times over the past several million years. The monument is pocketed with sinkholes and breccia pipes, structures associated with volcanism and the collapse of underlying rock layers through ground water dissolution. Parashant also contains portions of several active geologic faults in the area. These include the Dellenbaugh Fault, which cuts basalt flows dated 6 to 7 million years old; the Toroweap Fault, which has been active within the last 30,000 years; the Hurricane Fault, which forms the Hurricane Cliffs and extends over 150 miles across northern Arizona into Utah; and the Grand Wash Fault, which separates the Colorado Plateau and Basin and Range physiographic provinces (BLM 2007a).

Vermilion Cliffs National Monument is described in its proclamation as a geological resource worthy of protection. In the center of Vermilion sits the Paria Plateau, a terrace lying between the East Kaibab and the Echo Cliffs monoclines. The Vermilion Cliffs, which lie along the northern, eastern, and southern edge of the Paria Plateau, rise 3,000 feet in an escarpment capped with sandstone underlain by multicolored, actively eroding, dissected layers of shale and sandstone. The Paria River Canyon winds along the east side of the plateau to the Colorado River. Erosion of the sedimentary rocks in this 2,500-foot deep canyon has produced a variety of geologic objects and associated landscape features such as amphitheaters, arches, and massive sandstone walls (BLM 2007a).

In the northwest portion of the monument lies Coyote Buttes, an area where crossbeds of sandstone exhibit colorful banding in hues of yellow, orange, pink, and red caused by the precipitation of manganese, iron, and other oxides. Thin veins or fins of calcite cut across the sandstone, adding another dimension to the landscape.

The Vermilion Cliffs are composed of the Jurassic Moenave and Kayenta Formations. Directly at their base are the Chocolate Cliffs consisting of the Triassic Moenkopi Formation. The Paria Plateau and the Coyote Buttes are composed of Jurassic Navajo Sandstone, with scattered representations of Page

Sandstone, Carmel Formation, and Entrada Sandstone, also from the Jurassic period (BLM 2007a).

3.7.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located within the Palomas Plain, which is bounded on the southwest by the Palomas Mountains. The Palomas Plain is a typical basin found in the Basin and Range Province of the western U.S. In this area, the mountain ranges bounding the basins are all oriented to the northwest. The Palomas Mountains are an isolated portion of the Kofa-Tank Mountains complex, and the range's bedrock is composed of granitic, metamorphic rocks and volcanic rocks (DOE 2010).

There are no known unique or significant geologic features within the proposed Agua Caliente SEZ boundary. The subsurface geology is underlain by recent alluvial sediments varying from 200 to 600 feet thick that overly a thick sequence of volcanic rocks that extend to a depth of at least 2,500 feet. The volcanic rocks are highly fractured and there is an irregular contact between the volcanic unit and the overlying recent alluvium. The seismic hazard potential for the Yuma region is Seismic Zone 4 (subject to ground shaking), but the earthquake hazard risk for the area has been determined to be low by the Arizona Geologic Survey (DOE 2010). Minor faults occur in the area, but no significant faults that could generate major seismic activity or areas prone to liquefaction have been identified by Yuma County in their Comprehensive Plan in eastern Yuma County. The lack of significant faults results in the low earthquake risk for the area as determined by the Arizona Geological Survey (DOE 2010).

3.8 LAND USE AND REALTY

The primary goal of the Arizona Land Tenure Adjustment Strategy is to enhance the administration of public land ownership patterns through land tenure adjustments that acquire lands with high resource values and dispose of lands that are difficult and uneconomical to manage (BLM 2011i). To accomplish this objective, BLM Arizona will take action to provide the most effective configuration of lands and interests in land, consistent with land use plans developed through a full and open public involvement process, and to further the purposes of FLPMA. The land tenure program will support local community needs, further the public interest, secure exceptional natural values, and to the extent allowed by law, generate revenue from the enhanced management of the public land resources that remain in public ownership.

BLM adjustments to land tenure can occur via land exchanges and land sales. When in the public interest, it is the goal in land tenure adjustments to keep the surface and mineral estates together on both lands disposed of and acquired to benefit the future landowner's use and management of the land by avoiding the creation of split estate. Public lands selected for disposal typically meet the following criteria:

- Isolated and fragmented from larger tracts of BLM-administered lands;
- Adjacent to urbanizing private and state lands subject to future development;
- Present an economic and management challenge to retain under public ownership;
- Not within designated wildlife corridors;
- Not occupied by species listed or proposed as threatened or endangered under the ESA;
- Not designated or proposed critical habitat for listed or proposed threatened or endangered species;
- Not supporting listed or proposed threatened or endangered species if such transfer would conflict with recovery of the listed or proposed species; and
- Not supporting federal candidate species if such action would contribute to the need to list the species as threatened or endangered.

Acquisitions

Lands or interests in lands may be acquired through purchase, easement, and donation or through a land exchange. Acquisitions must be consistent with the BLM mission and with applicable land use plans.

Exchanges

An exchange must be determined to be in the public interest and fully consider better federal land management and the needs of state and local people. It must be determined that the values and objectives of the lands being acquired will be greater than the values of the federal lands being conveyed.

Sales

Public lands must be identified for disposal in a land use plan before being offered for sale. Public lands that are classified withdrawn, reserved, or have special designations are not available for sale. Under the authority of FLPMA, the BLM can sell public lands through competitive sales and exchange lands with other land management agencies and private landowners. Federal lands can only be sold at fair market value; that is, at a price comparable to private land sales.

3.8.1 RDEP Affected Environment

Arizona contains an estimated 72.1 million acres, or approximately 112,657 square miles. The surface land ownership in Arizona can be classified into four basic categories: Federal, State, Tribal, and Private (BLM 2011b). **Table 3-6**, Arizona Land Status, presents the total acreage and percentage of acreage by ownership. **Figure 3-13**, Surface Administration, shows land ownership.

Table 3-6
Arizona Land Status

Landowner	Acres	Percentage of Arizona Land
BLM	12,171,000	17
Forest Service	11,165,300	15
DOD	2,753,900	4
NPS	2,585,200	4
USFWS	1,705,600	2
BOR	178,100	<1
Tribal Lands	20,114,000	28
State	9,285,100	13
State or Local Parks	148,700	<1
State Wildlife Area	41,500	<1
County	14,300	<1
Private	12,779,900	18
Other	800	<1
Total	**72,943,400**	**100**

Source: BLM 2011b

This section provides an overview of land ownership and uses and consideration of land use plans. Lands managed for conservation (National Scenic and Historic Trails, and Special Designations) are described in **Section 3.18**, Special Designations. Recreation use on federal, state, and local government agency lands is discussed in **Section 3.15**, Recreation. The acreage data used in this section were the currently available data at the time of assembly and are still generally representative.

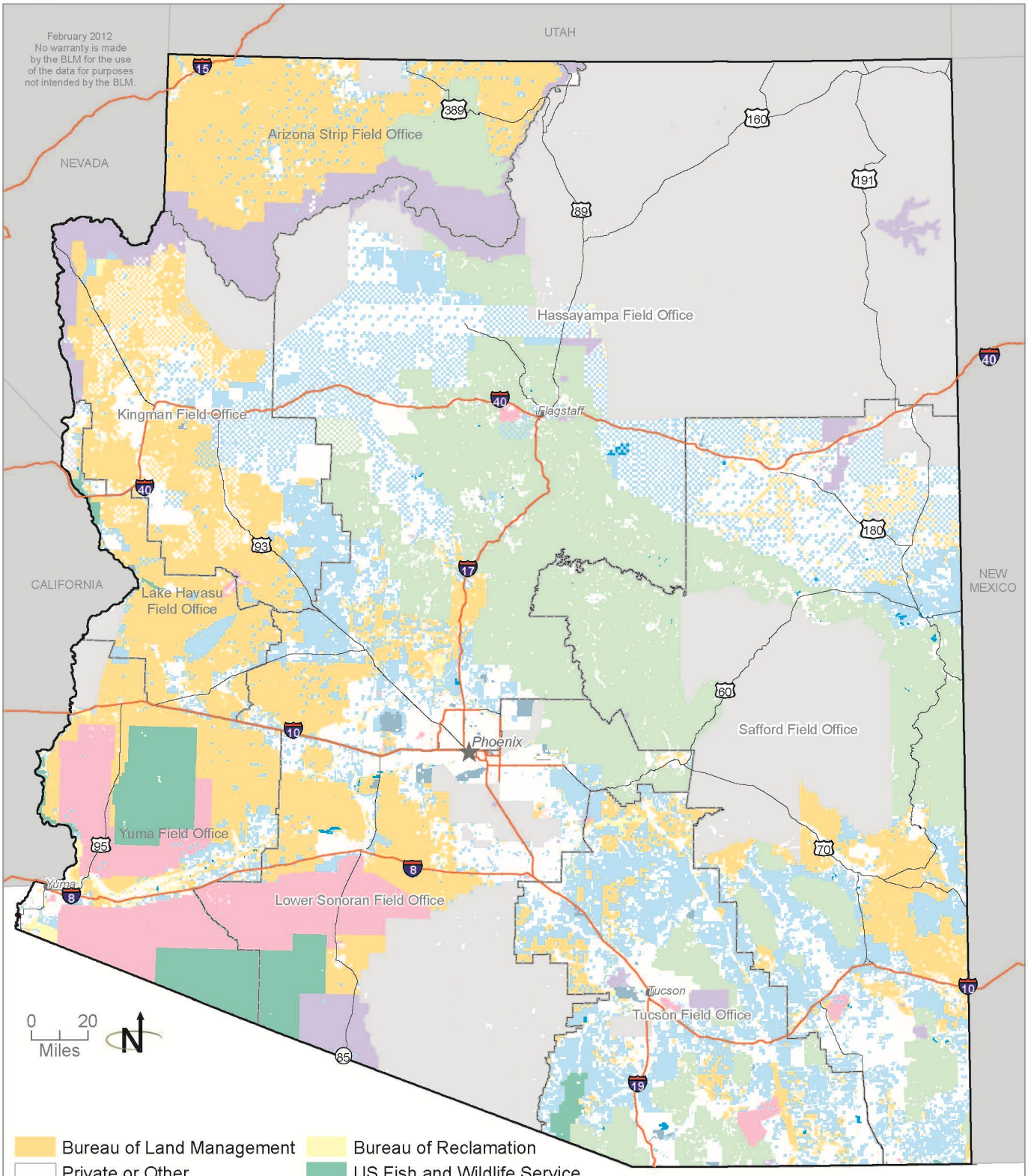
Federal Uses of Land in Arizona

The federal government owns about 30.6 million acres (about 42 percent) of the 72.1 million acres of land in Arizona. The majority of federal land is administered by the BLM (12.2 million acres, or 40 percent) and the Forest Service (11.2 million acres, or 37 percent) (BLM 2011b).

Each federal agency manages its lands and resources according to its mission and responsibilities. The BLM and Forest Service lands are managed for recreation, timber harvesting, livestock grazing, energy production, mining, wilderness protection, water and wildlife habitat, and other purposes. The U.S. Department of the Interior, National Park Service (NPS) manages lands for the conservation, preservation, protection, and interpretation of the nation's natural, cultural, and historic resources. The USFWS manages its lands for the conservation and protection of fish and wildlife and their habitats. The U.S. Department of Defense (DOD) manages its land to provide realistic test and training

Surface Administration

Arizona is 72.1 million acres, with 12.1 million acres of BLM-administered lands.



Source: BLM 2011b

Figure 3-13

environments for military operations as required by Title 10 (Armed Forces) of the United States Code. The U.S. Department of the Interior, Bureau of Reclamation (BOR) manages its lands primarily for water development.

The designation of REDAs and land use plan amendments could affect land use on federal lands. The acreages and land uses that could be affected are discussed in **Section 4.2.8**, Land Use and Realty.

BLM

The BLM's multiple-use mission, set forth in FLPMA, mandates that the agency manage public land resources for a variety of uses, such as energy development, livestock grazing, recreation, mining, and timber harvesting, while protecting a wide array of natural, cultural, and historical resources, many of which are found in the BLM's 27-million-acre National Landscape Conservation System (NLCS). The BLM currently administers approximately 12.2 million acres of land in Arizona, about 17 percent of the land area. These lands are often intermingled with other federal or private lands. The BLM also administers the subsurface mineral resources on these federal lands and supervises the mineral operations on Indian trust lands.

The BLM administers a variety of lands within Arizona, including rangelands, forests, wetlands, lakes, high mountains, and deserts. Land uses include livestock grazing; fish and wildlife habitat development and utilization; oil, gas, and mineral exploration and development; renewable energy development; ROWs; outdoor recreation; and timber production. These uses are managed within a framework of numerous laws, the most comprehensive of which is FLPMA. FLPMA established the "multiple use" management framework for public lands, so that "public lands and their various resource values … are utilized in the combination that will best meet the present and future needs of the American people" (from Section 103(c) of FLPMA). FLPMA ensures that there is no predominant or single use that overrides the multiple-use concept on any of the lands administered by the BLM. However, not all uses can occur on the land at the same time. Use of public lands shall be limited to areas where such use would not be inconsistent with land use plans or current uses. National monuments and other units of the NLCS system are managed with the intent of protecting the resources that are identified with these types of designated lands. Multiple uses of BLM-administered lands (and resources) are described as follows:

- Domestic Livestock Grazing. BLM Arizona issued 769 grazing permits and leases in 2010, primarily for cattle and sheep. It also issued permits for domestic horses, burros, and goats. Livestock grazing is managed on about 89 percent of the BLM-administered public lands in Arizona. Livestock grazing is discussed in detail in **Section 3.9**, Livestock Grazing.

- Fish and Wildlife Development and Utilization. Fish and wildlife habitat spans all of the lands and waterways managed by the BLM. The agency works with AZGFD, which is responsible for managing fish and wildlife populations on state lands. BLM funds many fish- and wildlife-related projects annually and plays an important role in the development and implementation of conservation plans for at-risk species. Wildlife and aquatic species conditions are discussed in detail in **Section 3.6**, Fish and Wildlife.
- Mineral Exploration, Development, and Production. Energy and mineral resources have the highest economic production values among commercial uses for surface lands and subsurface estates administered by the BLM in Arizona. These economic production values include exploration, development, and production of oil, natural gas, and geothermal resources; ROWs for associated pipelines and transmission lines; and locatable, leasable, and salable solid minerals. Locatable minerals, defined under the General Mining Law of 1972, can be obtained by locating a mining claim; they include both metallic (e.g., gold, silver, and lead) and nonmetallic (e.g., gemstones, fluorspar, and mica) materials. Leasable minerals are subject to the Mining Leasing Act of 1920 and include energy (e.g., coal) and non-energy (e.g., sodium, phosphate) resources; leases to these resources are obtained through a competitive bidding process. Salable minerals include basic natural resources such as sand and gravel that the BLM sells to the public at fair market value. The BLM may also grant free-use leases to states, counties, or other government entities for public projects. See **Section 3.5**, Energy and Minerals, for a detailed description of energy and mineral conditions.
- Rights-of-way. ROWs consist of an authorization to occupy, use, or traverse public lands. The BLM has been granted the authority to grant, issue, or renew ROWs for reservoirs, pipelines, renewable energy development, transmission lines, and transportation routes (e.g., roads, highways, trails, and railways).
- Outdoor Recreation. The vast majority of the American public's interaction with BLM-administered lands is through outdoor recreational activities. In 2005, more than 50 million visitors participated in activities such as rafting, hiking, biking, hunting, fishing, and camping on BLM lands throughout the U.S. Other activities include visits to heritage sites, national monuments, wild and scenic rivers, wilderness areas, national trails, and national conservation areas (BLM 2005a). Recreation use is discussed in **Section 3.15**, Recreation.
- Timber Production. About 1.7 million acres of BLM land in Arizona (14 percent) fall under the categories of forests and woodlands

(DOE and BLM 2008). BLM defines forests as lands with 10 percent or greater stocking in tree species used in commercially processed wood products (e.g., lumber, plywood, and paper). Woodlands are lands with 10 percent or greater stocking in tree species not typically used in commercial wood products (such as pinyon pine, juniper, and black spruce). Timber production is just one aspect of the BLM's forest management program.

Other commercial uses also occur on these lands (e.g., guides and outfitters and special uses such as filming or competitions).

U.S. Forest Service

Congress established the U.S. Forest Service in 1905 to provide quality water and timber for the nation's benefit. Its mission is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations. Types of land managed by the U.S. Forest Service throughout the western U.S. include national grasslands, land utilization projects, purchase units, research and experimental areas, national preserves, and other miscellaneous lands. In Arizona, national forests are the only type of land managed by the U.S. Forest Service (approximately 11.2 million acres, 15 percent of land area) (BLM 2011b). National forests are units of land formally established and permanently set aside and reserved for national forest purposes (e.g., as rangeland, timberland, and recreation land).

The Forest Service uses a multiple-use land management approach based on the principles outlined in the Multiple Use Sustained Yield Act of 1960 (16 USC 528) to sustain healthy ecosystems, repair damaged ecosystems, and address the need for resources and commodities. Multiple uses include the following:

- Administering and managing recreation, wilderness, and heritage areas and other congressionally designated areas (e.g., wild and scenic rivers and national recreation areas);
- Restoring, recovering, conserving, and enhancing fish and wildlife and their habitats;
- Managing forest, rangeland, minerals, and water resources in a sustainable manner;
- Conducting resource inventories and assessments of National Forest System (NFS) lands; and
- Providing a safe environment for the public and for Forest Service employees (Forest Service 2003).

The agency authorizes and administers the use of public lands by individuals, companies, organized groups, other federal agencies, and state or local levels of government to protect natural resource values and public health and safety. The following are some of the land uses authorized by the Forest Service Lands and

Realty Management Program related to infrastructure for generating and transmitting energy resources:

- Electricity transmission facilities;
- Oil and gas pipelines;
- Hydropower facilities; and
- Wind and solar facilities (Forest Service 2004).

NPS

The NPS was created in 1916 to protect the national parks and monuments managed by DOI. The approximately 2.8 million acres (four percent of total land area) managed by the NPS in Arizona includes one national historic park, two national historic sites, thirteen national monuments, one national memorial, three national parks, and two national recreation areas[2] (BLM 2011b).

USFWS

The USFWS was established in a 1940 reorganization plan when the DOI consolidated the Bureau of Fisheries and the Bureau of Biological Survey into one agency. The USFWS manages the 96.3-million-acre National Wildlife Refuge System (NWRS), which encompasses 547 national wildlife refuges, thousands of small wetlands, and other special management areas throughout the U.S. The Bankhead-Jones Farm Tenant Act, passed in 1937, was the authority used for establishing a number of wildlife refuges across the U.S. The approximately 1.7 million acres (two percent of total land area) managed by USFWS in Arizona includes national wildlife refuges, coordination areas, national fish hatcheries, and administrative sites (BLM 2011b). These categories are defined by the USFWS as follows:

- National Wildlife Refuge. Any area of the NWRS, excluding coordination areas and waterfowl production areas. Includes wilderness areas (service land managed in accordance with the terms of the Wilderness Act of 1964) and migratory waterfowl refuges (service land managed for the benefit of migrating waterfowl and other wildlife under the Fish and Wildlife Coordination Act).
- Coordination Area. Any area administered as part of the NWRS and managed by the state under cooperative agreements between the USFWS and the state's fish and wildlife agency.
- National Fish Hatchery. A facility where fish are raised. Hatchery objectives are to replenish depleted stocks, mitigate federal water projects, assist with the management of fishery resources on federal

[2] Acreage does not include Nevada portions of Lake Mead National Recreation Area (NRA), and Utah portions of Glen Canyon NRA.

(primarily USFWS) and tribal lands, and enhance recreational fisheries.

- Administrative Sites. Land used to support administrative programs, such as maintenance facilities or offices and off-site visitor centers.

DOD

The DOD owns and manages 3,748 sites, covering nearly 30 million acres worldwide, of which about 79 percent are located in the U.S. or in U.S. territories. The majority of land managed by DOD is used for military bases and bombing/firing ranges. Sites range in size from the very small, such as unoccupied locations supporting an Air Force navigational aid on less than one-half acre of land, to the very large, including the Army's White Sands Missile Range in New Mexico with more than 2.3 million acres. The majority of the land controlled by the DOD is government-owned or withdrawn public land (about 80 percent). The approximately 2.8 million acres (four percent of total land area) managed by DOD in Arizona include three Army bases (Camp Navajo, Flagstaff; Fort Huachuca, Cochise; and Yuma Proving Ground, Yuma County), three Air Force bases (Barry M. Goldwater Range, Phoenix; Davis-Monthan AFB, Tucson; and Luke AFB, Glendale), and one Marine Corps base (Marine Corps Air Station Yuma, Yuma) (BLM 2011b).

BOR

Established in 1902, the BOR is best known for the dams, power plants, and canals it constructed in the 17 western states. Today, it is the largest wholesaler of water in the country and is also the second largest producer of hydroelectric power in the western United States. Arizona is part of the Lower Colorado Region administered by the BOR. The region encompasses southern Nevada, southern California, most of Arizona, a small corner of southwestern Utah, and a small section of west-central New Mexico. In Arizona, the BOR manages approximately178,000 acres (BLM 2011b).

Some of BOR's projects in Arizona include the Central Arizona Project; Imperial Diversion Dam and the Yuma Project in Arizona; and the Hoover Dam and the Colorado River. The BOR delivers water for irrigation and domestic needs, supplies electricity through hydroelectric power plants, and provides recreation opportunities on the reservoirs and river stretches (BOR 2009).

Nonfederal Uses of Land in Arizona

Nonfederal lands in Arizona include privately owned lands, tribal and Indian trust lands, and lands controlled by state and local governments.

Tribal Land

There are 22 federally recognized Indian tribes with reservation land in Arizona. This tribal land encompasses approximately 20.1 million acres or 28 percent of Arizona's land base. Tribal lands are administered for recreation, timber

harvesting, livestock grazing, oil and gas production, mining, conservation, and functions vital to the culture and livelihood of the tribes.

State Trust Land

State trust lands are not public lands, but are instead the subject of a public trust created to support educational programs. The trust accomplishes this in a number of ways, including through its sale and lease of trust lands for grazing, agriculture, municipal, school site, residential, commercial and open space purposes.

Arizona has approximately 9.28 million surface acres and 9 million subsurface acres of trust lands. Scattered throughout the state, the trust lands are extremely diverse in character, ranging from Sonoran Desert lands, desert grasslands, and riparian areas in the southern half of the state to the mountains, forests, and Colorado Plateau regions of northern Arizona. The majority of the trust lands are located in rural areas of the state with more than one million acres located within or adjacent to urbanized areas. The trust lands constitute approximately 13 percent of land ownership in Arizona (Arizona State Land Department 2011).

State and Local Parks

There are approximately 148,700 acres of state and local parks in Arizona (BLM 2011b). The state park system in Arizona includes state parks and state historic parks, as well as other designations such as natural areas and recreation areas. Arizona currently has 30 state park units, which are managed wholly or partly by the Arizona State Parks government agency (Arizona State Parks 2011a). Local government parks also provide numerous recreation opportunities throughout the state.

State Wildlife Areas

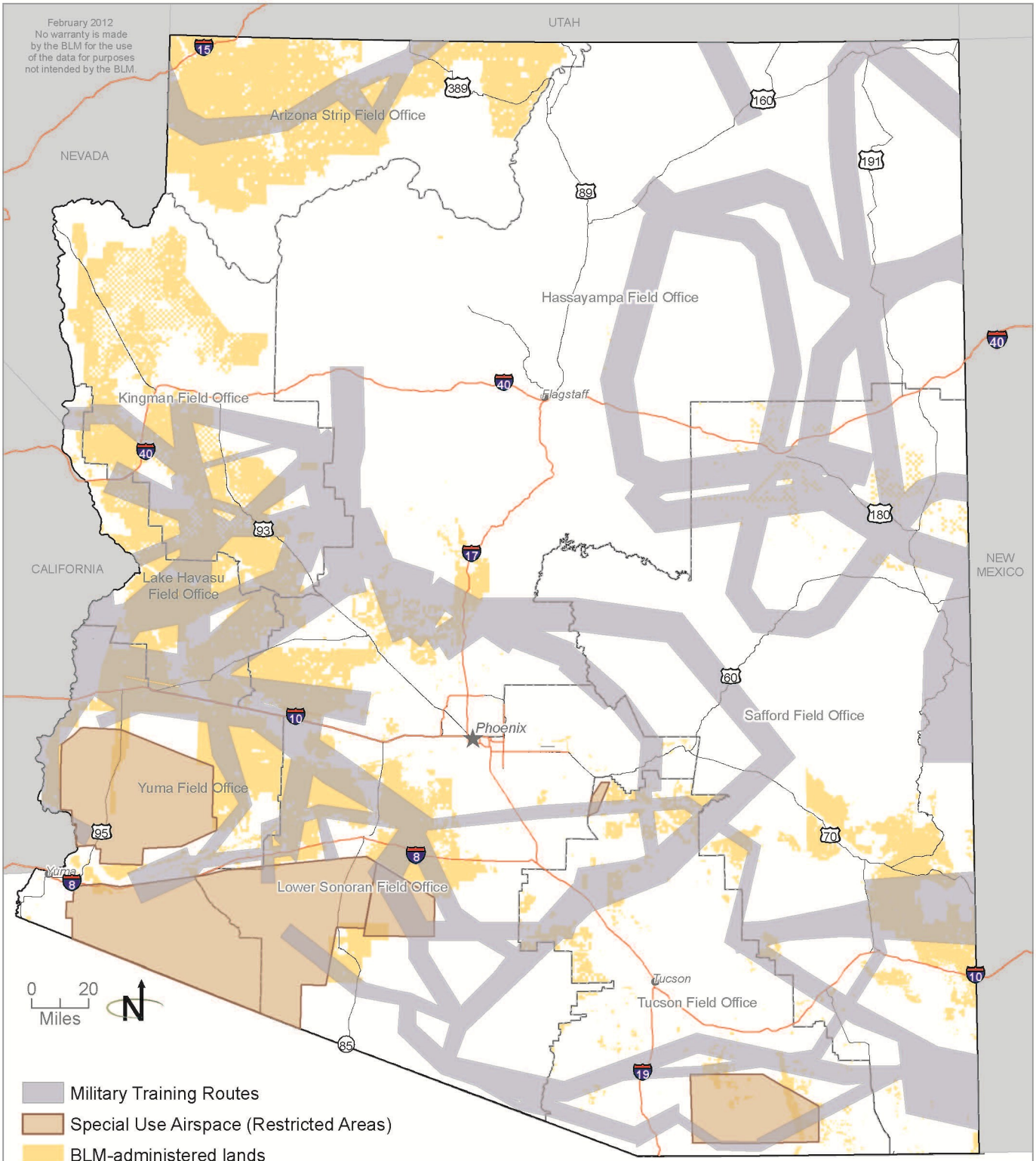
The AZGFD owns 41,500 acres of State Wildlife Areas (SWA) (BLM 2011b). Most wildlife areas are available for public use, generally including wildlife viewing, fishing, hunting, camping, hiking, and birding. All of the SWAs are located in the southern portion of the state (south of Interstate 40).

Aviation Considerations

The U.S. military uses airspace for its operations, some of which occur at low elevations (from 1,000 feet to as low as ground surface). Airspace restrictions under Special Use Areas (SUA) and Military Training Routes (MTR) are shown in **Figure 3-14**, Military Restricted Airspace. Development within these areas and corridors would require consultation with the DOD during project planning to ensure projects do not conflict with DOD training activities. Their specific locations and operational needs must be considered when siting solar and wind energy facilities, and related transmission facilities. Rather than just being individual routes or training areas, this military airspace forms a complex system that supports the training of military flight crews from all parts of the western United States.

Military Restricted Airspace

The US military uses airspace for its operations, some of which occur at low elevations (from 1,000 feet to as low as ground surface).



Source: BLM 2011b,
HQ, AF Bases, Ranges, & Airspace 2011

Figure 3-14

The presence of civilian airports and their operational airspaces also must be considered when siting solar and wind energy facilities, and related transmission facilities. There are 314 public or private airports and other aviation facilities in Arizona (GlobalAir 2011).

Another important consideration is the aircraft operations of BLM's National Office of Aviation and the Forest Service's Office of Fire and Aviation Management, which provide aircraft support for wildfire suppression and resource management missions on public lands.

Because of air navigation concerns associated with tall structures and structures built near airports, the locations of airports (and their related airspaces) and the flight patterns of various aircraft need to be taken into account when siting infrastructure (e.g., wind turbines and transmission towers). The Federal Aviation Administration (FAA) must be contacted for any proposed construction or alteration of objects within navigable airspace under the following categories:

- Proposed objects more than 200 feet above ground level at the structure's proposed location;
- Within 20,000 feet of an airport that has one runway longer than 3,200 feet, and the proposed object would exceed a slope of 100:1 horizontally from the closest point of the nearest runway;
- Within 10,000 feet of an airport or that does not have a runway more than 3,200 feet in length, and the proposed object would exceed a 50:1 horizontal slope from the closest point of the nearest runway; and
- Within 5,000 feet of a heliport, and the proposed object would exceed a 25:1 horizontal slope from the nearest landing and takeoff area of that heliport (FAA 2000).

The FAA could recommend marking and/or lighting a structure that does not exceed 200 feet above ground level, or that is not within the distances from airports or heliports mentioned above, because of its particular location (FAA 2000).

BLM Land Use Authorizations

The goals of the BLM lands and realty program are to manage public lands to support the goals and objectives of other resource programs, provide for uses of public lands in accordance with regulations and compatibility with other resources, and improve management of public lands through land ownership adjustments. The lands and realty program is a support program to all other resources to help ensure that BLM-administered public lands are managed to benefit the public.

BLM lands and realty actions include land use authorizations, which consist of ROWs, and other leases or permits. ROWs are authorized under FLPMA. Section 103(l) FLPMA identifies ROWs as one of the principal or major uses of the public lands. A ROW conveys an authorization to occupy, use, or traverse public lands. The BLM grants or renews ROWs on public lands for a variety of uses, including reservoirs; pipelines; electrical generation, transmission, and distribution systems; and roads. Once granted, a ROW conveys a right to occupy public lands and, depending on the specific ROW grant, may provide a priority for use of the public land for the specified term of the ROW. ROWs are typically issued for 20 to 30 years, but some may be granted in perpetuity. Through the land use planning process, the BLM may identify areas that are available for various types of ROWs and, in some areas, may identify where ROWs are either to be avoided or excluded. The BLM has also initiated efforts to streamline the solar and wind energy application processing procedures (Instruction Memorandum Nos. 2011-59, 2011-60, and 2011-61).

Through its land use planning process, the BLM has identified and continues to identify transmission corridors that are intended to provide locations on federal lands for future siting of electrical lines and pipelines. These corridors would be available to provide for transmission facilities to support renewable energy developments (DOE and BLM 2008).

A lease is an authorization to possess and use BLM land for a fixed period of time. A lease is issued when there is going to be substantial construction, development, and improvement and there is investment of large amounts of capital that will be amortized over time. Permits are authorized when uses of public lands will be short term and involve little or no land improvement, construction, or investment. Permits and leases are subject to processing and monitoring fees and a fair market rental value.

Renewable Energy

Arizona has been classified as having a highly favorable renewable energy climate due to having key policies in place that include green pricing programs, green power aggregation, net metering, and, most importantly, an RPS (BLM and DOE 2003). It is expected that public and private lands will continue to be considered for renewable energy development to meet the Arizona RPS that requires 15 percent of energy produced in the state be from renewable sources by 2025. This will include utilizing previously disturbed lands owned by federal, state, and local government agencies to minimize impacts on undeveloped lands.

In February 2003, BLM, in partnership with the Energy Efficiency and Renewable Energy division of the DOE, published a report entitled *Assessing the Potential for Renewable Energy on Public Lands*. The report used GIS data to analyze and assess the potential for CSP, PV, wind, and biomass resources and technologies on public land. This report represented an important initial activity of BLM's proposed National Energy Policy Implementation Plan, which is to identify and

evaluate renewable energy resources on public lands and any limitations on access to them. The BLM is using this information in prioritizing land use planning activities to increase industry's development and use of the renewable energy resources on public lands. These renewable resources include solar, biomass, geothermal, hydroelectric, and wind energy. Arizona BLM strategic goals include (BLM 2010b):

- Participating with landowners in the development of renewable energy strategies;
- Contributing to Arizona community power demands and state goals for development of renewable energy on public lands;
- Ensuring a full array of locations for solar and wind energy generation and transmission as part of statewide decisions about the footprint of renewable energy; and
- Focusing efforts on potential generation sites and transmission alignments that optimize natural resources on public lands together with technical and economic requirements.

Solar

The entire planning area has high enough solar intensity for development, with annualized Direct Normal Irradiance (DNI) levels of 6.5 or higher. Details and solar intensity maps are provided in the RFDS document produced for this project, included as **Appendix A**, Reasonably Foreseeably Development Scenario for Renewable Energy in Arizona.

Wind

Wind resource classes were examined within the planning area. Details and wind intensity maps are provided in the RFDS document produced for this project, included as **Appendix A**, Reasonably Foreseeably Development Scenario for Renewable Energy in Arizona. As shown in the following breakdown, the majority of the acreage identified as having wind potential occurs in the lowest commercially viable wind class, Class 3:

- Class 3 (Fair) – 885,941 acres
- Class 4 (Good) – 44,852 acres
- Class 5 (Excellent) – 10,801 acres
- Class 6 (Outstanding) – 3,591 acres
- Class 7 (Superb) – 396 acres

The acreage breakdown for BLM-administered lands by wind class is as follows:

- Class 3 (Fair) – 68,308 acres
- Class 4 (Good) – 3,746 acres

- Class 5 (Excellent) – 277 acres
- Class 6 (Outstanding) – 69 acres
- Class 7 (Superb) – 0 acres

With current wind development technologies, areas with slopes of 15 percent or greater are considered economically infeasible. The RFDS document, included as **Appendix A**, Reasonably Foreseeably Development Scenario for Renewable Energy in Arizona, eliminates such areas from the wind resource potential maps. The remaining lands of less than 15 percent slopes are considered to be the wind potential area. Potential maps and additional details are provided in **Appendix A**.

Biomass

In 2007, NREL produced a "Biomass Resource Assessments" for the state of Arizona (National Renewable Energy Lab 2007). This assessment quantified the existing or potential biomass material in the state. Biomass resources include agricultural crops and residues; dedicated energy crops; forestry products and residues; animal wastes; residues and byproducts from food, feed, fiber, wood, and materials processing plants; as well as post-consumer residues and wastes, such as municipal solid wastes and landfill gases. These biomass resources could be used to produce power, heat, transportation fuels, and various chemical products.

Most Arizona counties have the potential to produce less than 50,000 tonnes of biomass per year. Cochise and Yuma County have the potential to produce 50,000 to 100,000 tonnes of biomass per year; Pima County has the potential to produce 100,000 to 150,000 tonnes of biomass per year; Pinal and Navajo Counties have the potential to produce 150,000 to 250,000 tonnes of biomass per year; and Maricopa County has the potential to produce more than 500,000 tonnes of biomass per year (National Renewable Energy Lab 2007).

Summary

In 2007, new Arizona rules were adopted that expanded the state's RPS to 15 percent by 2025. This new standard will secure and likely expand the market of developing renewable energy resources across the state. It is anticipated that renewable energy development will take place in all regions of the state, and largely will be concentrated in rural areas. Arizona has been identified as the state with the best developable solar energy resource in the country. Its solar supply chain and green and renewable technology sectors have been growing rapidly, and this trend is expected to continue (Renewable Energy Focus 2010).

3.8.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located in Yuma County about 65 miles northeast of the city of Yuma, and 60 miles southwest of Buckeye. The proposed SEZ is bordered by BLM lands to the north and west, and state and private lands to the east and south. The area surrounding the proposed SEZ is

agriculture to the west and south, and undeveloped desert to the north and east.

Palomas Road, a Yuma County road, passes just south of the proposed SEZ and provides access to the proposed SEZ. A previously disturbed agricultural private inholding surrounded on three sides by the proposed SEZ is being developed for a 290-MW solar energy facility (Agua Caliente Solar Project). A large-capacity transmission line passes within approximately 0.5 mile of the proposed SEZ near the southern end of the area, and a new Palo Verde Hub to North Gila 500-kV transmission line is expected to be in service by 2014.

The proposed SEZ is primarily used for natural resource-based recreation opportunities, including hunting through motorized and nonmotorized means. Numerous transportation routes traverse the proposed SEZ, most heading north-south and crossing or originating/terminating on private and state land.

Renewable Energy

Solar

The proposed Agua Caliente SEZ has high enough solar intensity for development, with annualized DNI levels of 6.5 or higher. A 2,200-acre, privately owned area encompassed by the proposed Agua Caliente SEZ is under development by solar developer First Solar for a 290-MW photovoltaic project. Slopes within the proposed Agua Caliente SEZ are generally less than five percent, meeting slope requirements for the development of most solar technologies.

Wind

Wind resource classes were examined within the proposed Agua Caliente SEZ. The lowest commercially viable wind class is Class 3, and the proposed Agua Caliente SEZ has no acres rated as Class 3 or higher. Therefore, it has been determined that the proposed Agua Caliente SEZ has no developable wind potential.

Biomass

NREL's Biomass Resources Map for Arizona indicates that Yuma County has the potential to produce 50,000 to 100,000 tonnes of biomass per year. Yuma County is reported to be 5,189 square miles, or 3,352,000 acres in size. Because the proposed Agua Caliente SEZ is 20,600 acres (less than 1 percent of Yuma County) or less, a rough estimate can be made of how much biomass might be produced by the proposed SEZ in a given year, assuming that the proposed Agua Caliente SEZ represents a typical level of vegetation and rate of growth for Yuma County. Using this approach, it is estimated that the proposed Agua Caliente SEZ could produce a maximum of approximately 500 tonnes of biomass per year.

3.9 LIVESTOCK GRAZING

The primary laws that govern grazing on public lands are the Taylor Grazing Act of 1934, FLPMA, and Public Rangelands Improvement Act of 1978. Management direction is provided under 43 CFR Part 4100, BLM Handbooks 4100 to 4180, and BLM Manual H-4120-1.

The BLM provides for the following two types of authorized use for livestock grazing:

1. Grazing permits, which authorize use of the public lands within an established grazing district. Grazing districts are specific areas where public lands are administered in accordance with Section 3 of the Taylor Grazing Act; and

2. Grazing leases, which authorize use of public lands outside an established grazing district. Public lands outside grazing district boundaries are administered in accordance with Section 15 of the Taylor Grazing Act.

The terms and conditions for grazing on BLM-administered lands (such as stipulations on forage use and season of use) are set forth in the permits and leases issued by the BLM to public land ranchers. Under this management, ranchers may obtain a grazing permit for an allotment of public land on which a specified number of livestock may graze. An allotment is an area of land designated and managed for livestock grazing. The number of permitted livestock on a particular allotment on public land is determined by how many animal unit months (AUMs) that the forage resources will support. An AUM is the quantity of forage required by one mature cow and her calf (or the equivalent in sheep or horses) for one month.

3.9.1 RDEP Affected Environment

Approximately 10.9 million acres of BLM-administered lands are available for grazing in the planning area; this represents approximately 89 percent of the BLM-administered land in the state. A total of 1.3 million acres (11 percent) are unavailable for grazing. Recent land use plan amendments have increased the number of acres unavailable for grazing due to other resource concerns. As of 2010, the total number of grazing permits/leases on BLM-administered lands in the planning area was 769, of which 405 were authorized as Section 3 permits, and 364 were authorized as Section 15 leases. A total of 635,731 AUMs have active status as of 2011 (**Table 3-7**, Year 2010 Livestock Grazing Statistics for BLM-administered Lands in the Planning Area) (BLM 2011b).

The BLM manages Arizona rangelands in accordance with established rangeland health standards and guidelines. Livestock, fish and wildlife habitat, riparian, watersheds, and other resource values benefit from improving the vegetative habitat and rangeland health of BLM-administered lands.

Table 3-7
Year 2010 Livestock Grazing Statistics for BLM-administered Lands in the Planning Area

Leases and Permits	769
Section 3 permits	405
Section 15 leases	364
Active AUMs	635,731
Suspended AUMs	103,382
Allotments	834
Acres available for grazing	10,858,500
Acres unavailable for grazing	1,341,600
Grazing permits	769

Source: BLM 2011b

The BLM conducts land health assessments and evaluations of grazed land, develops vegetation objectives and integrates weed management into the livestock grazing program. Some examples of rangeland improvements include vegetation projects and fencing and wildlife/livestock water developments. Projects are generally initiated within priority watersheds and riparian areas and BLM-administered lands not meeting management objectives are given particular emphasis.

Based on the most recent BLM-administered land statistics for monitored rangeland, resource conditions on 2.1 million acres in Arizona were determined to be improving, 3.6 million acres were determined to be static, and 640 thousand acres were determined to be declining on public grazing lands in Arizona (BLM 2010c).

3.9.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is within the Palomas Grazing Allotment #03064, which consists of approximately 150,000 acres, including 110,000 acres of public lands. The allotment is authorized for ephemeral use only. Ephemeral rangelands produce a minor percentage of desirable perennial livestock forage but periodically provide annual vegetation suitable for grazing. The private land (White Wing Ranch) is located within the White Wing Allotment #05006. These allotments are not active and have not been active for some years.

3.10 NATIONAL TRAILS

3.10.1 RDEP Affected Environment

National scenic trails are extended trails that provide maximum outdoor recreation potential and for the conservation and enjoyment of the various qualities—scenic, historical, natural, and cultural—of the areas through which they pass.

National historic trails are extended trails that closely follow a historic trail or route of travel of national significance. Designation identifies and protects historic routes, historic remnants, and artifacts for public use and enjoyment. National historic trails must meet the following three criteria listed in Section 5(b)(11) of the National Trails System Act:

- They must follow actual documented route of historic use;
- They must be of national significance; and
- They must possess significant potential for public recreation and/or interpretation.

A "National Recreation Trail" designation is given to existing trails that contribute to health, conservation, and recreation goals in the U.S. While national scenic trails and national historic trails may only be designated by an act of Congress, national recreation trails may be designated by the Secretary of the Interior or the Secretary of Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trail's managing agency or organization. Through designation, these trails are recognized as part of America's national system of trails.

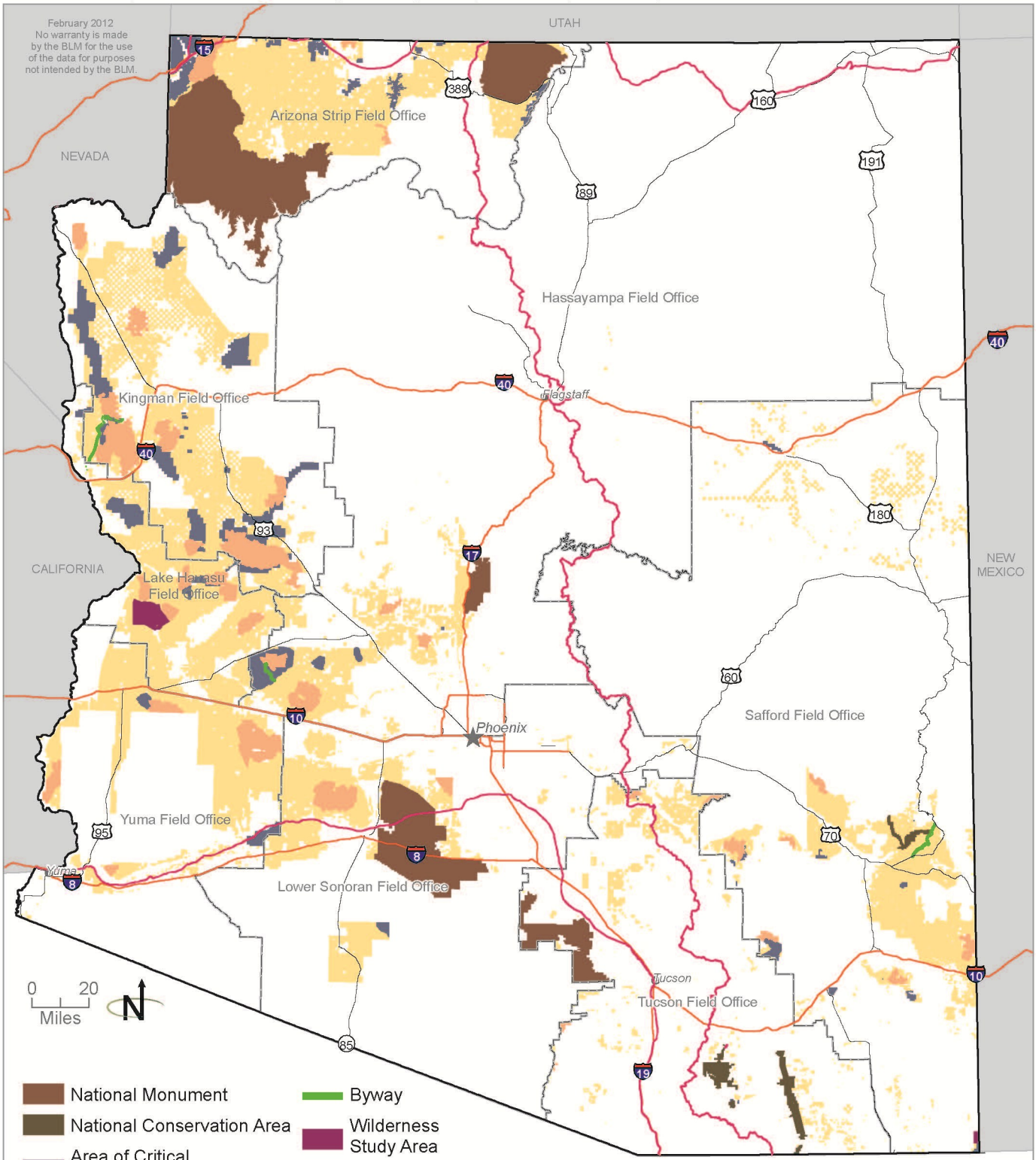
There are two national historic trails, the Juan Bautista de Anza National Historic Trail and the Old Spanish National Historic Trail, and one national scenic trail, the Arizona National Scenic Trail, in Arizona. The corridors of these trails total 34,400 acres on BLM-administered land in Arizona (**Figure 3-15**, Special Designations). Approximately 40 acres of private land of one nominated site overlaps the Juan Bautista de Anza National Historic Trail. Parts of these trails are affected by their proximity to urban areas, highways, utility corridors, or other modern developments. This proximity has impacted the viewsheds from the trails by introducing modern visual, aural, or atmospheric intrusion to their settings. For example, part of the Old Spanish National Historic Trail is underwater in Lake Mead. In addition, there are 34 national recreation trails in Arizona, two of which are managed by the BLM: Black Canyon Trail and Betty's Kitchen Interpretative Trail.

Juan Bautista de Anza National Historic Trail

The Juan Bautista de Anza National Historic Trail was designated on August 15, 1990, by the Juan Bautista de Anza National Historic Trail Act (Public Law 101-365). The trail comprises the overland route traveled by Captain Juan Bautista de Anza of Spain from Sonora, Mexico, to the vicinity of San Francisco, California during the years 1775 and 1776. The trail was used by Captain Juan Bautista de Anza to lead almost 100 people to California to establish the first permanent Alta California colony where followers were promised a better life (NPS undated). Other historic expeditions or travel routes, including the Butterfield Stage, Mormon Battalion, and pioneer travelers to the 1849 gold rush, followed portions of the Juan Bautista de Anza National Historic Trail.

Special Designations

Special designation areas protect unique characteristics that have been identified as scientifically, educationally, or recreationally important. BLM administers these areas with the intent to improve the manageability of the areas, allowing the agency to preserve, protect, and evaluate the significant components of national heritage. This figure depicts BLM special designations.



Source: ACERT 2011, BLM 2011b
The Arizona Council for Enhancing Recreation and Tourism (ACERT) Recreation and Historic Sites map has more information on Special Designations. It may be found by an Internet search for "Map of Recreation and Historic Sites in Arizona".

Figure 3-15

Old Spanish National Historic Trail

The Old Spanish National Historic Trail was designated on December 4, 2002, by the Old Spanish Trail Recognition Act of 2002 (Public Law 107-325). The Old Spanish National Historic Trail was a 2,700-mile trade route linking Santa Fe, New Mexico, and Los Angeles, California, passing through New Mexico, Colorado, Utah, Arizona, Nevada, and California. The trail had brief but heavy use between 1829 and 1848. During that period, Mexican and American traders took woolen goods west over the trail by mule train and returned eastward with California mules and horses for the eastern U.S. and Mexican markets (Old Spanish Trail Association 2011).

Spanish traffic on the trail was fairly constant between 1765 and 1821 to trade with the Ute Indians. Some trail users chose to trade with the Utes as far north as Salt Lake City, and followed a path now labeled the "North Branch," which led to Grand Junction, Colorado, before heading south to rejoin the other major route from Santa Fe via Green River, Utah. Mexican trader Antonio Armijo made the first commercial round-trip journey along a southern variant of the route in 1829 to 1830. William Wolfskill and George Yount's commercial pack train of 1830 to 1831 inaugurated consistent use of the entire route from 1830 to 1848. Use lapsed after the end of the Spanish American War in 1848, and by 1853, the Old Spanish National Historic Trail had been abandoned as a principal trade route (NPS 2001). The various historical routes together make up what is today known as the Old Spanish National Historic Trail.

Arizona National Scenic Trail

The Arizona National Scenic Trail was designated on March 30, 2009, by the Omnibus Public Land Management Act (Public Law 111-11). The Arizona National Scenic Trail is a more than 800-mile recreation trail from Mexico to Utah that connects mountain ranges, canyons, deserts, forests, wilderness areas, historic sites, trail systems, points of interest, communities, and people. It serves day hikers, backpackers, equestrians, mountain bicyclists, trail runners, nature enthusiasts, cross-country skiers, snowshoers, and mule and llama packers (Arizona Trail Association undated).

The many different features on and near the Arizona National Scenic Trail showcase many of Arizona's greatest attributes, including historic sites, diverse natural features and geologic wonders, quaint communities, and large remote wilderness areas. Prehistoric and historic sites dot the entire trail. These sites include the mining history at Kentucky Camp, the cliff dwellings at Tonto and Walnut Canyon National Monuments, the historic Roosevelt Dam, 1900 tourism era structures and trails of Grand Canyon National Park, the former railroad town of Patagonia, the former logging railroads near Mormon Lake, and the early Forest Service history of General Springs Cabin (Arizona Trail Association undated).

Notable natural features include the diverse life zones and elevation changes throughout the state, allowing a diversity of vegetation and wildlife. Some describe these various life zones as similar from going from Mexico to Canada, and are especially evident in southern Arizona's sky islands. These features include geologic wonders such as Grand Canyon National Park, Colossal Cave, and the White Canyon area (Arizona Trail Association undated).

3.10.2 Agua Caliente Solar Energy Zone Affected Environment

No national scenic, historic, or recreation trails occur within the proposed Agua Caliente SEZ. However, the Juan Bautista de Anza National Historic Trail corridor is located approximately five miles south of the proposed SEZ, and the proposed SEZ would be visible from the trail corridor.

3.11 NATIVE AMERICAN INTERESTS AND HERITAGE RESOURCES

Tribal interests include economic rights related to Indian trust assets and resource uses and access guaranteed by treaty rights. "Indian trust assets" means lands, natural resources, money, or other assets held by the federal government in trust or restricted against alienation for Indian tribes and individual Indians (Secretarial Order No. 3215, April 28, 2000).

The NHPA requires federal agencies to consider the effects of their actions on historic properties, including places of traditional religious and cultural importance to Indian tribes. Executive Order 13007, Indian Sacred Sites, was designed to accommodate access to sacred sites on federal land and to avoid harm to these sites "to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions."

Areas of cultural heritage importance to tribes may include archaeological sites; TCPs; traditional territories; areas used for traditional hunting, resource gathering, social events, or ceremonies; trails; graves and cemeteries; places associated with important events; or geographic features. The connections among places within a particular geographic landscape may also have cultural meaning.

Native American interests may also extend to the potential effects of renewable energy development on tribal economies and business ventures, public health and safety, traditionally important plants and animals, or other issues. Tribal consultation and coordination is essential to fully identify and analyze potential environmental and social consequences of development within the REDAs.

Tribal Consultation and Coordination

The BLM Arizona notified and initiated consultation with 23 federally recognized Native American tribes concerning the RDEP (see **Chapter 6**, Consultation and Coordination, for a summary of government-to-government consultation on the RDEP). The Native American tribes involved include the following:

- Hopi Tribe
- Pueblo of Zuni
- Navajo Nation
- Pascua Yaqui Tribe
- San Carlos Apache Tribe
- White Mountain Apache Tribe
- Tonto Apache Tribe
- Hualapai Tribe
- Havasupai Tribe
- Yavapai Prescott Indian Tribe
- Yavapai-Apache Nation
- Fort McDowell Yavapai Nation
- Salt River Pima Maricopa Indian Community
- Gila River Indian Community
- Ak-Chin Indian Community
- Tohono O'odham Nation
- Colorado River Indian Tribes
- Fort Mojave Tribe
- Fort Yuma-Quechan Tribe
- Cocopah Tribe
- San Juan Paiute Tribe
- Kaibab Paiute Tribe
- Chemehuevi Tribe

3.11.1 RDEP Affected Environment

Ethnographic History

As described in **Section 3.4**, Cultural Resources, the proposed REDAs cluster into eight geographic areas that are described in this EIS as cultural regions (see **Figure 3-4**, RDEP Cultural Regions, in **Section 3.4**, Cultural Resources). These regions are environmentally distinct areas that were associated with distinct groups of Indian tribes possessing shared languages, histories, and ways of life. **Figure 3-16**, Arizona Indian Reservations, shows the current locations of Arizona Indian reservations. Prior to the establishment of reservations, Indian tribes inhabited the entire state and many of their traditional territories far exceeded the boundaries of current tribal lands.

The following discussion relates tribal territories and general ethnographic information to the eight cultural regions.

Lower Gila Cultural Region

Tribes who inhabited or used this region include the Cocopah, Quechan, Maricopa (Pee Posh), Tohono O'odham, Yavapai, and related peoples (Ortiz 1983). The former three tribes lived in settlements, some of which may have been seasonal, along the Colorado River and lower Gila River. They relied to a great degree on farming and fishing, but also ventured into the adjacent deserts and mountains for hunting, resource collection and processing, and other activities. Traditional use areas and trails were located both near and away from the rivers.

The Tohono O'odham resided in the desert south of the Gila River and tended to rely to a greater degree on wild plant and animal foods, though they also farmed. Some groups moved seasonally between desert and mountain camps. Hia'ced groups subsisted on hunting and gathering in the very arid western area of the Papagueria south of the Gila River. Western Yavapai groups lived near springs in the Castle Dome and Kofa mountain ranges north of the Gila River (Ortiz 1983).

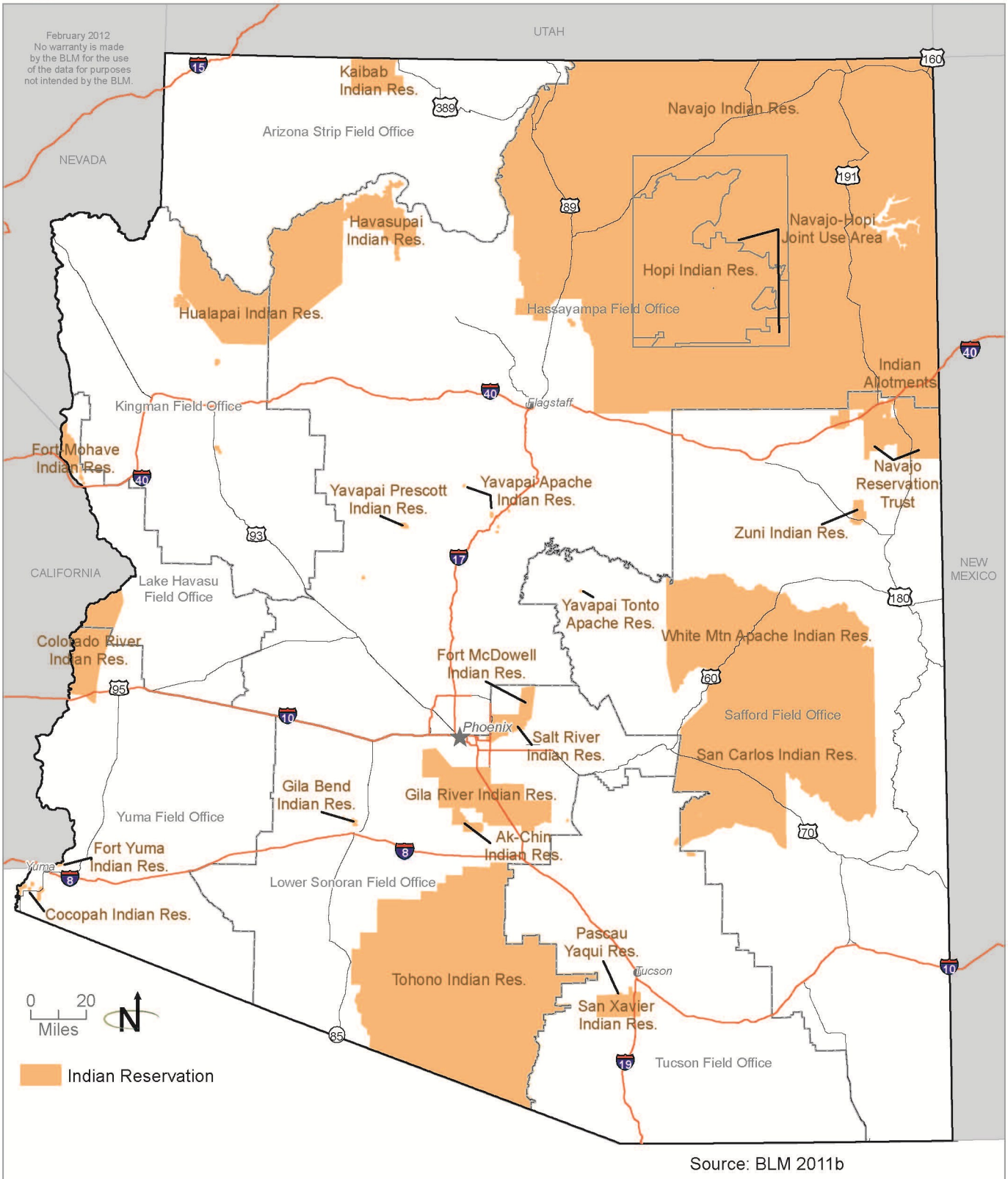
Heritage resources of tribal concern include TCPs, springs, trails, intaglios and geoglyphs, graves or other features with human remains, petroglyphs and pictographs, and other traces of past activities. Some tribes have elaborate cultural geographies that define interconnections and relationships among important mountains, other geographic features, trails, and various types of archaeological sites. They have expressed concern about potential direct and indirect (visual, auditory, and access) impacts to these places from renewable energy development.

Southern Patayan Cultural Region

Tribes who inhabited or used this region include the Yavapai, Mohave, and Chemehuevi (Ortiz 1983). The Mohave lived along the Colorado River, where

Arizona Indian Reservations

Indian Reservations in Arizona.



Source: BLM 2011b

Figure 3-16

they relied on farming and fishing but frequently traveled into the deserts and mountains to hunt and gather wild resources. Mohave oral histories describe extensive travels throughout this area (Stone 1986).

The Yavapai subsisted primarily on wild resources and traveled seasonally to exploit important plant and animal foods. They also farmed where conditions permitted. Groups of the Western Yavapai inhabited camps in the Harquahala and Harcuvar mountain ranges, where springs were available (Ortiz 1983). The Chemehuevi lived primarily west of the Colorado River but ventured east of the river on hunting expeditions (D'Azevedo 1986). Some Chemehuevi also reside in the Colorado River Indian Tribes community near Parker.

Heritage resources of tribal concern are similar to those identified for the Lower Gila Cultural Region.

Northern Patayan Cultural Region

Tribes who inhabited or used this region include the Mohave, Hualapai, Havasupai, Yavapai, and Chemehuevi (Ortiz 1983). The Hualapai were grouped into a series of bands whose territories were centered on certain mountain ranges, canyons, and valleys. They generally relied on wild plant and animal foods and moved seasonally to take advantage of a wide range of food sources, although they also grew crops near water sources. They were closely related to the Havasupai, who inhabited parts of the Grand Canyon and adjacent Colorado Plateau. The Hualapai also maintained social and trade relations with the Mohave along the Colorado River.

Heritage resources of tribal concern are similar to those identified for the Lower Gila Cultural Region. Areas along the Colorado River that contain intaglios, geoglyphs, and trails are particularly sensitive. Another topic of concern is the impact on views from culturally important mountains and topographic features. In prior consultations with government agencies, the Hualapai have identified Red Lake and the surrounding area as one of special concern. This playa zone in the Hualapai Valley was an important area where many bands gathered to collect grass seeds that played a key role in subsistence, such that no single band laid claim to the area (Stone 1987).

Tusayan/Northern Plateau Cultural Region

Tribes who inhabited or used this region include the Southern Paiute, Hualapai, Havasupai, Hopi, and Navajo (Ortiz 1983; D'Azevedo 1986). Southern Paiute tribes inhabited areas north of the Grand Canyon and other parts of the Colorado Plateau in northern Arizona. They generally relied on wild plant and animal foods and moved seasonally to take advantage of a wide range of food sources, although they grew crops near water sources. Traditional Paiute territories are largely outside the proposed REDAs, except for areas that may have been used on a temporary basis for hunting or travel.

The Hualapai and Havasupai established seasonal camps south of the Grand Canyon to exploit pinyon nuts and other upland resources. All of the above mentioned tribes, as well as the Zuni, traveled to sites of traditional religious and cultural importance in and around the Grand Canyon. Long-distance trade routes also passed through this region.

Heritage resources of tribal concern include archaeological sites, trails, springs, petroglyphs and pictographs, the Colorado River, the Grand Canyon, the San Francisco Peaks, and Red Butte.

Little Colorado Cultural Region

Tribes who inhabited or used this region include the Hopi, Pueblo of Zuni, Navajo, and Western Apache (Ortiz 1979, 1983). The Hopi and Zuni, descendants of Ancestral Puebloan peoples, lived in pueblo villages and relied to a great degree on farming, but hunting and gathering provided additional sources of food and raw materials. Hopi territory is centered on the Colorado Plateau in northeastern Arizona, but Hopi oral history describes a series of ancient migrations through many areas of Arizona. The Pueblo of Zuni is in western New Mexico, but Zuni territory extended into eastern Arizona. Both tribes ascribe cultural importance to a number of prehistoric pueblos and other ancestral sites throughout the Little Colorado region.

The Apache and Navajo speak the Apachean branch of Athapaskan native languages. Groups of the Western Apache lived in the highlands of eastern and central Arizona. They generally relied on wild plant and animal foods and moved seasonally to harvest a wide range of food sources, though they grew crops near water sources (Ortiz 1983). Much of the traditional Apache territory consists of rugged mountainous or forested areas where no REDAs have been proposed. Navajo traditional territory is on the Colorado Plateau. The Navajo originally relied on a diverse base of subsistence, including hunting, gathering, farming, and trading. After contact with the Spanish, sheep and other livestock became an important addition to the Navajo economy and engendered a pastoral way of life with a rich tradition of weaving (Ortiz 1979).

Heritage resources of tribal concern include ancestral pueblo sites such as those in Homolovi State Park, petroglyphs and pictographs, trails, other archaeological sites, Woodruff Butte near Holbrook, and the "Zuni Heaven" lands owned by the Pueblo of Zuni near Petrified Forest National Park.

Safford/San Simon Cultural Region

Tribes who inhabited or used this region include the Western and Chiricahua Apache and the Zuni (Ortiz 1979, 1983). The Hopi and O'odham tribes have ancestral connections to the region by virtue of their cultural ties to the prehistoric Ancestral Puebloan and Hohokam traditions. Archaeological and ethnographic evidence indicates that this was a region of cultural and adaptive diversity with territorial boundaries changing through the centuries. The Apache

groups were more mobile, while the Puebloan and O'odham-related peoples were more settled and relied to a greater degree on farming.

Heritage resources of tribal concern include ancestral pueblo sites, petroglyphs and pictographs, other archaeological sites, traditional gathering areas for acorns and other important resources, and geographic landmarks such as Mount Graham near Safford.

Santa Cruz/Tucson Cultural Region

Tribes who inhabited or used this region include the O'odham and the Pascua Yaqui (Ortiz 1983). The O'odham tribes share a common Piman language and are linked to the prehistoric Hohokam and Sobaipuri cultural traditions. Various groups of the O'odham include the Akimel (Pima) and Tohono (Papago), who currently live in four reservations (Salt River Pima-Maricopa Indian Community, Ak-Chin Indian Community, Gila River Indian Community, and Tohono O'odham Nation). Their traditional territories covered large areas of central and southern Arizona. The Pascua Yaqui tribe moved within a large territory of northern Mexico and southern Arizona and currently occupies a reservation near Tucson; there is another Yaqui community at the village of Guadalupe near Phoenix.

The Akimel groups lived along the Salt, Gila, and Santa Cruz Rivers and relied to a large degree on farming but ventured into the deserts and mountains to hunt and collect natural resources. The Tohono groups resided in the desert and tended to rely to a greater degree on wild plant and animal foods, though they also farmed. Some groups moved seasonally between desert and mountain camps.

Heritage resources of tribal concern include archaeological sites, petroglyphs and pictographs, pools and other water sources, historic sites and missions, and geographic landmarks such as Baboquivari Peak.

Phoenix Basin/Middle Gila Cultural Region

Tribes who inhabited or used this region include the O'odham tribes, Maricopa, and Yavapai (Ortiz 1983). O'odham settlements and farms were located along the middle Gila, Salt, and lower Santa Cruz Rivers. They traveled to the surrounding desert basins and mountains to hunt and collect wild resources to supplement their diet. The Maricopa (Pee Posh) people and related groups spoke a Yuman language and originally lived along the Colorado and lower Gila Rivers, but migrated eastward to settle in areas currently surrounding Gila Bend and Phoenix, where they lived near their allies the Akimel O'odham (Pima) (Spier 1933).

Various groups of the Yavapai also inhabited this region, particularly in the upper elevations west and north of present-day Phoenix. Most Yavapai groups traveled seasonally over an extensive territory to harvest wild plant foods, though they farmed at suitable locations near rivers, streams, and springs.

Heritage resources of tribal concern include archaeological sites, petroglyphs and pictographs, pools and other water sources, and natural features such as certain hills or mountain peaks.

In conclusion, these diverse tribes were connected to each other through long-distance interaction networks maintained through trade and social relationships, and their territories often overlapped. The tribes continue to regard many locations within their traditional territories, including types of archaeological sites, trails, and natural features, as places of traditional cultural importance. Effective tribal consultation is critical to identifying such areas of traditional use or importance potentially affected by renewable energy development (see **Chapter 6**, Consultation and Coordination for additional information).

3.11.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is in the Lower Gila cultural region, within or near the traditional territories of the Maricopa, Quechan, Cocopah, Western Yavapai, and Tohono O'odham.

Historically, the Kaveltcadom, a Yuman-speaking group related to the Maricopa, lived along the lower Gila River. Records indicate that several villages were located between Gila Bend and the Mohawk Mountains, the largest of which were near Gila Bend (Spier 1933). Dwellings were often widely dispersed along the river, rather than clustered at specific locations. The native people farmed along the river but also hunted in the nearby desert basins and mountains where they gathered mesquite beans, saguaro cactus fruits, and other wild foods.

Near the area of the proposed SEZ, there were settlements on the south side of the Gila River at Agua Caliente and Palomas, about ten miles west of Agua Caliente. The village near Agua Caliente was called "xakupi'nc" or "hot water" in reference to the nearby hot springs (Spier 1933, p. 24). Remnants and traces of the people's activities and movements, including trails, could be present as archaeological sites in the SEZ.

3.12 NOISE

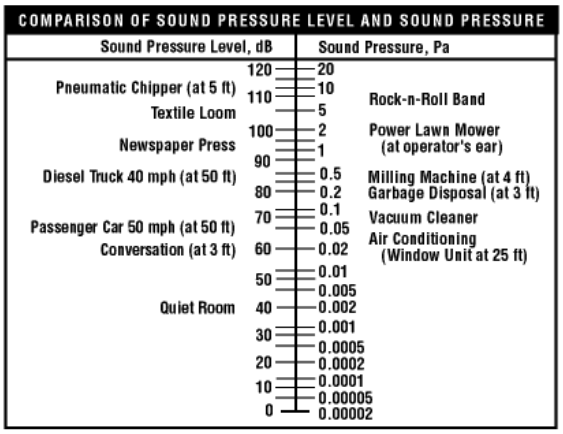
This section describes environmental noise fundamentals, background noise levels, noise propagation, and noise standards and guidelines related to solar and wind development projects.

Fundamentals

Noise is defined as any undesirable sound that interferes with normal activities or in some way reduces the quality of the environment. Response to noise varies according to type, perceived importance, appropriateness in the setting, time of day, and the sensitivity of the individual receptor. Sound is any pressure variation that the ear can detect. Sound pressure levels are measured in units of decibels. Any time a sound level (or sound pressure level) is referred to, a decibel notation is implied.

Audible sounds range from 0, considered the quietest sound that can be heard by an average person, called the "threshold of hearing," to about 130, which is considered so loud that it causes pain, and is called the "threshold of pain" (**Figure 3-17**, Comparison of Sound Pressure Level and Sound Pressure). The perceived pitch of a sound, which characterizes the sound as being high or low when heard, is determined by its frequency. Low-pitched or bass sounds have low frequencies, and high-pitched or treble sounds have high frequencies. A healthy, young person can hear sounds with frequencies ranging from approximately 20 to 20,000 cycles per second (hertz). The sound of human speech is typically in the range of 300 to 3,000 hertz (Canada's National Occupational Health and Safety Resource 2008).

Figure 3-17 Comparison of Sound Pressure Level and Sound Pressure



[1] dB = decibel

Source: Canada National Occupational Health and Safety Resource 2008

Sound measurement is further refined by using a decibel "A-weighted" sound level (dBA) scale that more closely describes how a person perceives sound. The A-weighted decibel scale estimates the range of human hearing by filtering out lower frequency noises, which are not as damaging as high frequencies. This scale is widely used in noise standards, guidelines, and ordinances, and is widely accepted in analyzing noise and its impacts on humans. **Table 3-8**, A-Weighted Decibel Scale and Example Noise Conditions provides the sound pressure levels associated with some familiar noise sources.

The EPA developed an index (threshold) to assess noise impacts from a variety of sources using residential receptors. Noise levels in a quiet rural area at night are typically between 32 and 35 dBA. Quiet urban nighttime noise levels range from 40 to 59 dBA. Noise levels during the day in a noisy urban area are frequently as high as 70 to 80 dBA. Noise levels above 110 dBA become intolerable and then painful; levels higher than 80 dBA over continuous periods can result in hearing loss. Constant noises tend to be less noticeable than irregular or periodic noises (EPA 1974). Although an A-weighted sound may adequately indicate the level of sound at a given instant, it does not account for the duration of the sound or variations in sound level over time. To assess these variations, two descriptors are often used, L_{dn} and L_{EQ}. The day-night average sound level (L_{DN} or DNL) is the average A-weighted sound level during a 24-hour period with 10 decibels added to nighttime levels (between 10:00 PM and 7:00 AM). This adjustment is added to account for the fact that human sensitivity increases during the nighttime hours when people are involved in more noise-sensitive activities (e.g., sleeping). The equivalent continuous sound pressure level (L_{eq}) is a sound level that, if maintained continuously during a specific time period, would contain the same total energy as sound that varied over that time.

Table 3-8
A-Weighted Decibel Scale and Example Noise Conditions

Characterization	dBA	Example Noise Condition or Event
Threshold of Hearing	0	---
Barely audible	5	---
	10	Audiometric testing booth
Very quiet	15	---
	20	Empty recording studio
	25	---
	30	Quiet rural area, winter night, no wind; whisper, quiet library
Quiet	35	---
	40	Quiet suburban area at night
	45	Typical rural area daytime background conditions
Moderately noisy	50	Typical daytime suburban background conditions
	55	Typical urban residential area away from major streets
	60	Typical daytime urban mixed use area conditions, background music, conversation in restaurant
	65	Typical daytime busy downtown background conditions
Noisy	70	Auto, 35 mph at 20 feet; 300 feet from busy 6-lane freeway
	75	Street sweeper at 30 feet; Idling locomotive, 50 feet
Very Noisy	80	2-axle commercial truck, 35 mph at 20 feet
	85	City bus at 30 feet
8-hour workplace limit	90	Heavy truck, 35 mph at 20 feet; leaf blower at 5 feet
Extremely noisy	95	Locomotive horn at 100 feet, subway train at 200 feet
Possible building damage	100	Outboard motor, jackhammer, snowmobile, motorcycle
	105	Emergency vehicle siren at 50 feet, power lawn mower at 3 feet
	110	Peak crowd noise, pro football game, open stadium
	115	F/A-18 aircraft takeoff with afterburner at 1,600 feet, loud rock concert
	120	Mach 1.1 sonic boom under aircraft at 12,000 feet
Threshold of pain	125	F/A-18 aircraft takeoff with afterburner at 470 feet, pneumatic riveter at 4 feet
	130	Surface detonation, 30 pounds of TNT at 1,000 feet

Source: Data compiled from various published sources.
dB = decibel

Statistical values of noise levels are also frequently used to describe time-varying characteristics of environmental noise measured in A-weighted decibel scale. The L_{eq} values typically used are L_{10}, L_{50}, and L_{90}, representing noise levels that are exceeded at 10, 50, and 90 percent of the time, respectively. L_{10} represents a sound level considered intrusive, L_{50} is the median noise level, and L_{90} corresponds to background noise.

Noise effects on humans fall into three categories:

- Subjective effects such as annoyance, nuisance, and dissatisfaction;
- Interference with activities such as speech, sleep, and learning; and
- Physiological effects such as anxiety, tinnitus, or hearing loss.

Determining if a noise is objectionable depends on the type of noise (tonal, broadband, low frequency, or impulsive), in addition to the circumstance and individual sensitivity of the person who hears it. Typically, the levels associated with environmental noise only produce effects in the first two categories. However, workers subjected to noise in environments such as industrial plants or airports may experience noise effects similar to those described under the third category. **Table 3-9**, Subjective Response to Changes in Sound Level, illustrates how differences in sound magnitudes are perceived by humans.

Table 3-9
Subjective Response to Changes in Sound Level

Change in Sound Level	Perceived Change in Loudness
±1 decibel	Requires close attention to noise
±3 decibels	Barely perceptible
±5 decibels	Quite noticeable
±10 decibels	Dramatic; sounds nearly twice or half as loud
±20 decibels	Striking; fourfold change in loudness

Source: Berendt, Corliss, and Ojalvo 2000

Noise Propagation

Predicting the noise level at a receptor location depends on a complex combination of source characteristics and site-specific factors (Anderson and Kurze 1992), including the following:

- Source characteristics such as sound power, directivity, and configuration;
- Geometric spreading (geometric divergence) as the sound moves away from the source to the receptor;

- Atmospheric air absorption, which depends strongly on the sound frequency and relative humidity, less strongly on temperature, and slightly on pressure;
- Ground effects due to sound reflected by ground surfaces interfering with the sound propagating directly from the source to the receptor;
- The topography, structures, and other natural or human-made barriers between the source and the receptor; and
- Meteorological factors such as turbulence and variations in vertical wind speed and temperature.

The 'transmission path' or medium for sound or noise is most often the atmosphere (i.e., air). In order for the noise to be transmitted, the transmission path must support the free propagation of the small vibratory motions that make up the sound. Atmospheric conditions (e.g., wind speed and direction, temperature, humidity, precipitation) influence the attenuation of sound. Barriers and discontinuities that attenuate the flow of sound may compromise the path.

At short distances (less than 160 feet), the wind has a minor effect on the sound level. For locations at greater distances from a given source, wind can cause considerable differences in sound levels. Wind speed typically increases with height, and this variation focuses it in the downwind direction and creates a shadow in the upwind direction. Therefore, upwind sound levels will be lower, and downwind levels higher, than if there were no wind.

Changes in temperature with height also play a major role in sound propagation. During the day, air temperature decreases with height. In contrast, on a clear night, the temperature often increases with height (a condition known as a temperature inversion). The speed of sound varies with temperature so that generally sound bends (refract) upward during the day, leading to reduced sound levels on the ground, and bends downward during inversions, leading to higher sound levels on the ground. Such temperature effects are uniform in all directions, differing from those of wind that affect mostly upwind and downwind direction.

Noise Standards and Guidelines

The federal law that directly affects noise control is the Noise Control Act of 1972, as amended by the Quiet Communities Act of 1978 (42 USC 4901-4918). This act delegates to the states the authority to regulate environmental noise. It also directs government agencies to comply with local community noise statutes and regulations, and to conduct their programs to promote an environment free of any noise that could jeopardize public health or welfare.

3.12.1 RDEP Affected Environment

Background noise is the noise from all other sources than the source of interest (e.g., construction activities or wind turbines in operation). The background noise level can vary considerably depending on the location. There is currently

no available information defining existing noise levels in the REDA, which would be recorded as background noise levels at any given project site. Natural soundscapes are an accumulation of all natural sounds that occur in the unpopulated places such as wilderness areas. Background noises expected to exist in such areas include agricultural activities, mining operations, traffic, recreation activities (including mechanized and motorized uses), weather, and aircraft overflights.

3.12.2 Agua Caliente Solar Energy Zone Affected Environment

There is no available information defining existing noise levels in the proposed Agua Caliente SEZ. Aside from some trails and a few dirt roads, the proposed SEZ is undeveloped. Palomas Road is approximately 0.6 mile from the southern edge of the proposed SEZ. Background noise within the proposed SEZ is expected to include vehicular movements on roads, possible off-highway vehicle uses, farm equipment from adjacent agricultural operations, weather, and construction activities from the construction of the First Solar Agua Caliente Solar Project.

From a review of aerial photography and field visits to the proposed SEZ areas, no sensitive receptors (e.g., hospitals, schools, or nursing homes) appear to exist within one mile of the proposed SEZ. The nearest obvious residence from the proposed SEZ boundary is about 1.5 miles to the northeast of the northeastern corner of the proposed SEZ. Other buildings that could potentially be residences exist within the privately owned agricultural lands enveloped by the proposed SEZ that are planned for the development of a solar project.

3.13 PALEONTOLOGICAL RESOURCES

Paleontological resources are any fossilized remains, traces, or imprints of organisms preserved in the Earth's crust. Fossils include bones, teeth, shells, leaves, wood, and tracks originally buried in sedimentary deposits. Paleontological resources include not only the actual fossils but the sedimentary deposits containing the fossils. Geological deposits provide context for the fossils, such as their age, habitat, and climate at the time of deposition. Paleontological resources are important to the understanding of Earth's history, as they make it possible to:

- Investigate the mechanisms behind evolution and the interrelationships of life through the history of Earth;
- Study patterns and processes of evolution, extinction, and speciation;
- Determine the nature and effects of previous climate change episodes and how they compare to ongoing climate change;
- Study the geographic distribution of organisms and tectonic movements of land masses and ocean basins through time;

- Reconstruct ancient environments, climate change, and paleoecological relationships;
- Use fossils to biostratigraphically link or differentiate geological units over wide geographic areas; and
- Provide a measure of relative geological dating, which forms the basis for biochronology and biostratigraphy.

Sensitivity levels are determined based on the Potential Fossil Yield Classification (PFYC) system used by the BLM. BLM uses the PFYC system to assess the potential of geological deposits to contain paleontological resources. The PYFC system uses a scale of 1 to 5 to classify geological units based on the known, or expected, relative abundance of vertebrate fossils and/or scientifically significant invertebrate and plant fossils.

Class 1 geological units have very low potential to contain recognizable fossil remains. Units of Precambrian age and most volcanic deposits have low potential.

Class 2 areas have low potential for fossil remains, except in rare circumstances. Examples include some types of sedimentary rocks, as well as deposits less than 10,000 years old.

Class 3 units typically are sedimentary deposits, commonly marine in origin, that have moderate or unknown potential to contain fossils. Such occurrences may be widely scattered within the geological unit.

Class 4 areas have a high potential for significant fossil resources, which have been documented but may vary in occurrence and predictability.

Class 5 units have a very high potential and predictably produce significant fossils that are at risk of human-caused adverse impacts or natural degradation.

Literature research, institutional record searches, and the PFYC provided the information necessary to assign a sensitivity level of high, low, or moderate/undetermined to the planning area. Any future provisions for mitigation of adverse impacts on significant paleontological resources exposed during construction-related activities are based upon these determinations of sensitivity level. The terms high sensitivity level, moderate/undetermined sensitivity level, and low sensitivity level are defined below:

- High Sensitivity Level: Geological units classified as high sensitivity have a high density of recorded fossil localities, have produced fossils in or near the vicinity of a project area, are very likely to yield additional fossils during construction, and contain significant paleontological resources. Areas identified as having a Class 4 or 5 in the PFYC system are considered to have a high sensitivity level.

- Moderate/Undetermined Sensitivity Level: Geological units classified as moderate/undetermined sensitivity level have limited exposure in a project area, are poorly studied, or contain no recorded paleontological resource localities. However, in other areas, the same or similar geological units may contain sufficient paleontological localities to suggest that exposures of the unit in a project area would have at least a moderate potential for yielding fossils. Areas with a Class 3 in the PFYC system are considered to have a moderate or undetermined sensitivity level.
- Low Sensitivity Level: Geological units classified as low sensitivity level contain no, or a very low, density of recorded fossil localities, have produced little or no fossils in the vicinity of a project, and are not likely to yield any fossils. Nevertheless, geological units with few or no prior recorded fossil localities can still prove fossiliferous during paleontological mitigation activities. Areas identified as having a Class 1 or 2 in the PFYC system are considered to have a low sensitivity level.

3.13.1 RDEP Affected Environment

Paleontological resources are present in all three physiographic provinces of Arizona: the Colorado Plateau, the Transition Zone, and the Basin and Range. Each of these provinces contains distinctive paleontological resources that reflect the geological and evolutionary history of Arizona. Potential for any area to contain paleontological resources depends upon the geologic formations found within an area and the paleontological sites found to date within the formation.

The Colorado Plateau Province in northern Arizona contains a number of the most fossiliferous geological units in Arizona. Paleontological resources from the Colorado Plateau Province are dominated by collections from Paleozoic and Mesozoic rocks. Permian fossils from the Hermit Shale and Coconino Sandstone include tracks and traces of reptiles and mammal-like reptiles (Hunt et al. 2005; Hunt and Santucci 1998). Lower to Middle Triassic fossils from the Moenkopi Formation include fossil fish (e.g., *Moenkopia wellesi* and *Taphrognathus bradyi*), amphibians (e.g., *Hadrokkasaurus bradyi*, *Vigilius wellesi*, *Eocyclotosaurus wellesi*, *Stanocephalus birdi*, and *Cosgriffus campi*), and reptiles (e.g., *Anisodontosaurus greeri*, *Ammorhynchus navajoi*, *Arizonasaurus babbitti*, and *Rhadalognathus boweni*) (Heckert et al. 2005; Nesbitt 2005). Triassic fossils from the Chinle Formation include petrified wood (*Araucarioxylon arizonicum*) and a diverse assemblage of reptiles and early dinosaurs that includes *Coelophysis sp.* and *Chindesaurus bryansmalli* (Parker 2005). Upper Triassic and Lower Jurassic fossils from the Glen Canyon Group include fossils of crocodylomorphs, mammal-like reptiles, and early dinosaurs. Trace fossils include tracks of crocodylomorphs and dinosaurs (Lucas et al. 2005a).

Paleontological resources from the Transition Zone Province in central Arizona are dominated by collections from Cenozoic rocks. The Prescott Local Fauna in the Milk Creek Formation contains canid, gomphothere, horse, camel, and pronghorn fossils (Honey and Taylor 1978). Fossils from the Verde Formation include fish, salamander, tortoise, turtle, lizard, snake, bird, bat, rabbit, ringtail, numerous rodents, gomphothere, horse, camel, and pronghorn (Morgan and White 2005; Czaplewski 1987a; Czaplewski 1987b; Lindsay and Tessman 1974).

Paleontological resources from the Basin and Range Province in southern and western Arizona are dominated by collections from Mesozoic and Cenozoic rocks. Cretaceous fossils have been collected from the Amole Arkose, Fort Crittenden Formation, and Bisbee Group. The fossils of the Amole Arkose include the Tucson Mountain Dinosaur (*Tenontosaurus* sp.) (Lucas et al. 2005b). Fossils from the Fort Crittenden Formation include a diverse assemblage of fish, lizards, and dinosaurs (McCord and Gillette 2005). Fossils from the Bisbee Group include fish, turtles, crocodiles, and dinosaurs that include *Sonorasaurus sp.*, *Acrocanthrosaurus sp.*, *Deinonychus sp.*, unnamed titanosaur, unnamed nodosaur, and *Tenontosaurus sp.* (McCord and Gillette 2005). Early Pleistocene fossils of the 111 Ranch Beds include ground sloth, glyptodont, bat, dog, weasel, ringtail, bear, hyena, cat, rabbit, rodents, horse, tapir, camel, pronghorn, and gomphothere (Morgan and White 2005; Tomida 1987).

In summary, the planning area in the Colorado Plateau Province has the greatest potential for paleontological resources, with 1,047,642 acres containing geological units with a very high to moderate potential for paleontological resources. The portion of the planning area that falls within the Basin and Range Province has the next highest potential for paleontological resources, with 495,405 acres containing geological units with a high to moderate potential for paleontological resources. Most of this area in central and western Arizona does not have a high potential for paleontological resources. Areas with a higher paleontological potential are located in southeastern Arizona. The parts of the planning area that fall within the Transition Zone Province have the least potential for paleontological resources, with only 173,838 acres containing geological units with a high to moderate potential for paleontological resources.

Paleontological resources are affected by a number of factors directly and indirectly related to a project. These factors can include ground disturbance, erosion, and illegal collecting. Arizona is rich in paleontological resources, but as with other states, economic constraints often determine how much research is done. Arizona has a significant amount of federal and state lands managed by the BLM, Forest Service, and State of Arizona. The BLM and Forest Service provide guidelines for managing paleontological resources on federal lands. Paleontological resources are not regulated on private lands. Urban development has created the need for more electrical transmission lines, as well as oil and gas pipelines. These types of projects, along with construction of renewable energy projects, provide a greater opportunity to study the

paleontological resources in Arizona. A large number of these projects are located on federal and state lands. Ongoing and future development of renewable energy projects are expected to have continued effects on paleontological resources.

3.13.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located within the Palomas Plain, which is bounded by the Palomas Mountains to the west and Baragan Mountain to the north. Both mountains are mapped as Tertiary volcanic rocks (Demsey 1990; Spencer 1995; Richard et al. 2000). The valley-fill deposits of the Palomas Plain include Quaternary surficial deposits and Tertiary alluvial-fan deposits (Richard et al. 2000). The Tertiary volcanic rocks have a very low potential (Potential Fossil Yield Classification of 1) for containing paleontological resources, because volcanic rocks do not preserve fossils. Quaternary surficial deposits have a low potential (Potential Fossil Yield Classification of 2) for containing paleontological resources, because of their young age. The Tertiary alluvial-fan deposits within the proposed SEZ have an unknown potential (Potential Fossil Yield Classification of 3) for containing paleontological resources, because these sediments are of an age and composition that may preserve fossils.

No known fossil localities occur within the proposed SEZ or within one-mile of the analysis area. However, fossil rodent, camel, and other land mammals ranging in age from the Miocene to the Quaternary have been collected to the west of the proposed SEZ along the Gila River near Wellton, Arizona (Sauter et al. 2011b). Also, fossilized packrat middens, which scientists have used to reconstruct ancient environments, may occur in caves or other sheltered areas in either Tertiary or Quaternary geological units.

3.14 PUBLIC HEALTH AND SAFETY

This section describes health and safety concerns associated with solar and wind energy development and then describes the likelihood of existing soil and water contamination at the proposed Agua Caliente SEZ.

3.14.1 RDEP Affected Environment

Construction

Hazardous Materials Management. Fuels, oils, lubricants, and solvents are the primary hazardous and flammable materials typically on site during the construction and operation of solar and wind energy facilities; these substances are required for the operation of construction equipment. Small quantities of additional common hazardous materials are typically used on site during construction, including antifreeze and used coolant, latex and oil-based paint, paint thinners and other solvents, cleaning products, and herbicides. Substation construction requires mineral oil-based transformer oil to be transported to the site for use in step-up transformers. Some transformers can use non-toxic biodegradable vegetable oil (which contains no petroleum). Workers can also be exposed to residual pesticides and herbicides that may be present in soils at a

project site through inhalation of contaminated dust or, if in direct contact with site soils, absorption through the skin.

Worker Safety. In addition to exposure to hazardous materials, typical worker hazards include electrocution, fires, and accidents (such as slips, trips, or falls). Hunting in the vicinity of project sites could also pose a risk of injury or death to construction workers.

Public Safety. Construction sites can pose a safety hazard for members of the general public if access is not restricted. Members of the public can fall into open pits, trenches, holes, or can be injured while climbing on large structures or equipment. Increased traffic on planning area roadways has the potential to increase the risk for traffic accidents, particularly during rainy periods and wet areas and periods with higher tourist traffic.

Exposure to Contaminated Sites. On-site soils may be contaminated with a variety of chemicals leftover from former land uses, or may have migrated into onsite soils via surface water or groundwater flow from nearby contaminated sites. Workers can be exposed to such contamination during project construction through inhalation of dust from contaminated soils, or, if in direct contact with site soils, absorption through the skin.

Operation

Hazardous Materials Management. During operations and maintenance, it is typical for small quantities of hazardous materials to be periodically and routinely transported, used, and disposed of. These materials typically consist of minor amounts of petroleum products (fuels and lubricating oils) and a small to moderate amount of motor vehicle fuel. Small quantities of additional common hazardous materials are often used on project sites, including antifreeze and used coolant, latex and oil-based paint, paint thinners and other solvents, cleaning products, and herbicides. Minor hazardous materials releases can occur due to improper handling and storage practices during operation and maintenance activities.

Wildland Fires. Vegetation can be ignited from operation and maintenance activities such as welding sparks, fires from equipment failure, and other activities, including smoking by project personnel or guests. Such fires can pose a health and safety risk to personnel or nearby residences or businesses.

Electromagnetic Fields (EMF). EMFs are associated with electromagnetic radiation. Electric and magnetic fields are common throughout nature and are produced by all living organisms. Concern over EMF exposure, however, generally pertains to human-made sources of electromagnetism and the degree to which they may have adverse biological effects or interfere with other electromagnetic systems. Possible health effects associated with exposure to EMFs have been the subject of scientific investigation since the 1970s. Reviews of the scientific literature

have consistently indicated insufficient evidence of an association between EMF exposure and adverse health effects in humans.

Hunting. Hunting in the vicinity of project sites could pose a risk of injury or death to operational personnel, could damage project components, and could trigger the release of hazardous materials into the environment.

3.14.2 Agua Caliente Solar Energy Zone Affected Environment

A search of federal and state records indicate no present or past contamination or presence of underground storage tanks at the site or within a quarter mile of its boundaries. No data on existing groundwater quality are available. The existing agricultural operations within the private lands largely surrounded by the southern portion of the proposed Agua Caliente SEZ may have contributed nitrates as well as other chemicals used as fertilizers, herbicides, and pesticides into groundwater beneath the proposed SEZ.

As described in **Section 3.4**, Cultural Resources, the proposed SEZ contains lands formerly used for at least three military ranges during World War II. These ranges consist of the East Artillery Range and two combat ranges used for .30-caliber small arms training. Topographic maps and aerial imagery reveal the presence of at least two landing strips within the current planning area. Several buried crates containing grenades and rifles were found during planting operations at the White Wing Ranch following the Army's departure from the area. Local residents claim to have observed a number of exploded and unexploded ordnance in the area, including 20-mm projectiles and cartridges, 2.36-inch bazooka rockets, 81-mm mortars, 25-pound practice bombs, and .50-caliber bullets and cartridges. It is likely that the SEZ contains both exploded and unexploded ordnance.

3.15 RECREATION

3.15.1 RDEP Affected Environment

The diverse planning area offers multiple settings for a wide range of opportunities for recreation, most on public land requiring no permits and no or minimal fees.

Popular recreational activities include driving for pleasure, hiking, mountain biking, camping, hunting, fishing, off-highway vehicle (OHV) riding, horseback riding, rock climbing, skiing, visiting cultural sites, bird watching, viewing wildflowers, backpacking, and seasonal whitewater boating. Flying radio-controlled aircraft, rock crawling, parasailing, and geocaching are also growing in popularity in parts of the planning area.

Visitor use patterns within many parts of the planning area are seasonal. Due to extreme summer heat, some areas receive very little summer use but become popular destinations during winter months. In warmer parts of the planning area the winter season generally runs from late October through late March. Winter

visitors are typically retired persons or seniors migrating to the area from relatively colder climates such as the Northwest and Midwest U.S. and Canada. Most winter visitors spend an extended period, usually 2 to 6 months, in these areas. Summer recreation in the hotter desert areas is virtually intolerable due to excessive heat. Winter use in these hot, lower-elevation and upland deserts is popular.

Water-based recreation is an important component of the Arizona recreation landscape. Boating, sport fishing, and water sports (e.g., waterskiing, wakeboarding, etc.) are popular on Arizona's lakes, reservoirs, and rivers.

Snow-based winter recreation, including downhill and cross-country skiing, is popular in higher elevation areas. The Arizona Snowbowl outside of Flagstaff and Sunrise Park Resort near Greer offer lift-assisted downhill skiing. Cross-country skiing and snowshoeing opportunities are available on public and private lands.

The majority of recreational opportunities on public lands are located on federal lands managed by the BLM, Forest Service, BOR, and other agencies.

Arizona's 12.1 million acres of BLM-administered lands offer a wide variety of recreational experiences, ranging from hiking, horseback riding, and mountain biking to motorcycle and OHV riding, boating, and more. Each BLM field office manages its own recreation program and social and environmental conditions, and facilities usually dictate the types of activities that occur in a given area.

Special Recreation Management Areas (SRMAs) were traditionally areas that had higher recreation use or required extra recreation investment or where more intensive recreation management was needed. SRMAs are areas identified in land use plans to direct recreation funding and personnel to fulfill commitments made to provide specific "structured" recreation opportunities (i.e., activity, experience, and benefit opportunities). SRMAs now must identify a distinct, primary recreation-tourism market (destination, community, or undeveloped), as well as a corresponding and distinguishing recreation management strategy. Recreation settings or natural resource settings are prescribed as part of the land-use allocation decision. Subsequent implementing actions, as identified in the activity planning framework, are proactive and address management, marketing and visitor information, and monitoring and administration. See **Figure 3-18**, Special Recreation Management Areas for locations that have been designated SRMAs on BLM-administered lands.

Arizona's six national forests provide a variety of structured and unstructured recreation opportunities similar to BLM-administered lands.

Special Recreation Management Areas

Special Recreation Management Areas (SRMAs) are administrative units with unique recreation values and where recreation is the prominent management focus.

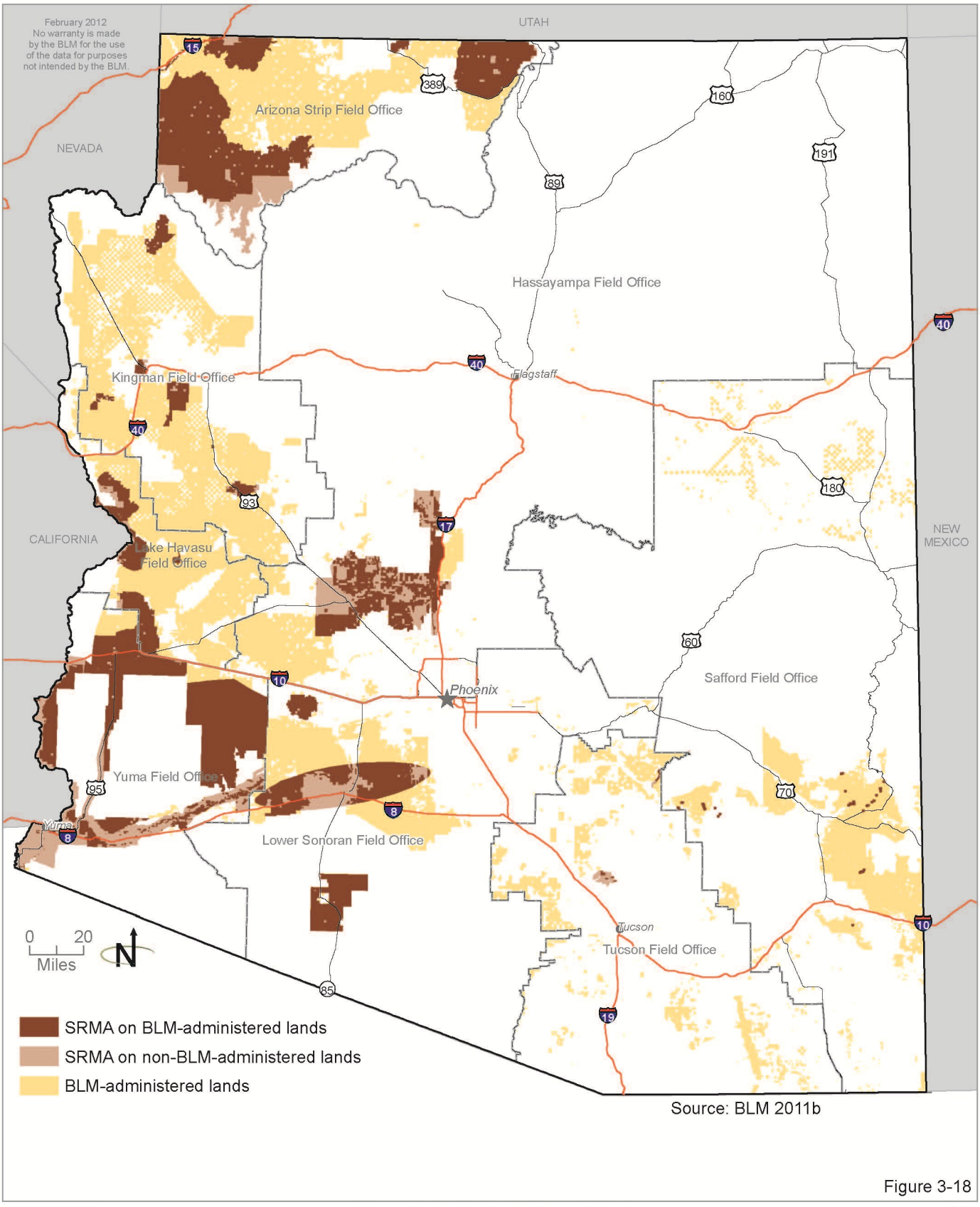


Figure 3-18

There are 25 units of the National Park System in Arizona, including three national parks (Grand Canyon, Petrified Forest, and Saguaro National Parks) and two national recreation areas (Glen Canyon and Lake Mead National Recreation Areas). These areas provide a wide variety of automobile touring, developed and dispersed camping, and dispersed quiet recreation opportunities. Off-highway motorized vehicle recreation is generally more restrictive in NPS units (also see **Section 3.18**, Special Designations).

Arizona State Parks manages 29 state parks, natural areas, and state historic parks. Due to budget restrictions two parks are currently closed to the public and four other parks are open on a reduced schedule (Arizona State Parks 2011b). State parks charge an entrance fee for day use, and developed recreation opportunities such as camping also require a fee. Once in a state park, dispersed recreation is generally free of cost.

Some state trust lands are available for a variety of day-use activities. OHV riding, paintball, horseback riding, hiking, and mountain biking are some of the uses allowed on parcels of state trust lands where a right-of-way, permit, or authorization has been granted.

Non-government recreation providers also play an important role in producing recreation and tourism opportunities on public lands. Many local and regional businesses provide for a variety of direct recreation opportunities on public and state lands that enable visitors to realize specific recreation experiences via numerous commercial and competitive activities or events.

Stretching more than 800 miles from the Utah border to the Mexico border, the Arizona National Scenic Trail provides an unparalleled nonmotorized recreation experience for mountain bicyclists, hikers, equestrians, and more. Many sections of the trail were constructed by volunteers and the route itself crosses numerous local, state, and federal land parcels.

The Great Western Trail also traverses Arizona in a north-south manner on its way from Mexico to Canada. This route, comprised mainly of existing backcountry roads, is open to motorized and nonmotorized uses.

Rafting, kayaking, boating, fishing, and swimming are popular along the Colorado River as it winds through Arizona. The lower Colorado River attracts families and groups from metropolitan centers in southern California and Phoenix who come for water-based recreation activities from May to September.

Recreation use is expected to continue to grow throughout the planning area. Because of the tremendous population growth in Arizona and the surrounding region, day users will probably represent the fastest growing user group. In addition, the proximity of many recreation opportunities to the metropolitan areas of Phoenix, Las Vegas, and Southern California has dramatically increased

recreational visitation within portions of the planning area and is expected to continue to do so.

3.15.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located within the Yuma Field Office's 526,900-acre Yuma East Undeveloped SRMA. The SRMA is split into two recreation management zones (RMZs), including the Dispersed Use RMZ in which the proposed SEZ is located. The primary management strategy for the SRMA is to target the demonstrated undeveloped tourism market. The area is a regional hunting destination, and the SRMA's exemplary wildlife habitat supports this activity. More specifically, the Dispersed Use RMZ is managed to continue to provide undeveloped and wildlife-based recreation opportunities through motorized and nonmotorized means. The RMZ's wildlife habitat and wildlife populations continue to provide local communities with access to natural resource-based recreation opportunities, and younger generations are provided with opportunities to develop hunting, camping, and outdoor skills. The RMZ is part of AZGFD Game Management Unit 41 and also provides exemplary OHV riding, hiking, and wildlife and wildflower viewing opportunities (BLM 2010g).

Administrative actions for the RMZ include providing sustainable opportunities for hunting, camping, OHV riding, hiking, wildlife and wildflower viewing; promoting environmental education programs; and partnering with agencies and organizations to cooperatively and comprehensively manage the area.

3.16 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The construction and operation of solar, wind, or other renewable power plants contributes to local, state, and national economies directly through the creation of jobs (particularly during the construction phase), generation of property taxes, and payments of revenues, and indirectly through the addition of employees' incomes into the local economy. The current and projected economic contributions of solar resources in particular have been examined in the state. Estimates of the direct contributions of solar energy in Arizona in 2010 are shown in **Table 3-10**, Solar Energy Direct and Indirect Economic Contributions. The contribution of renewable resources and solar energy in particular to the local and state economy is expected to increase over the next twenty years due to the higher cost of traditional energy sources, renewable portfolio standards requiring an increasing percentage of power from renewable sources, and increasingly competitive pricing for renewable resources. The following section contains an overview of current social and economic conditions in the planning area. Additional details are provided in the Socioeconomic Baseline Assessment Report prepared for this project (BLM 2012b).

Table 3-10
Solar Energy Direct and Indirect Economic Contributions[1]

Temporary Construction Jobs (direct only)	565
Temporary Construction Jobs (direct, indirect, and induced)	1,068
Temporary Construction Wages (direct, indirect, and induced)	$51 million
Permanent O&M Jobs (direct, indirect, and induced)	3
Permanent O&M Annual Wages (direct, indirect, and induced)	$200,000

[1]2010 estimates
Source: Frisvold et al. 2009
O&M – Operations and Maintenance

3.16.1 RDEP Affected Environment

The socioeconomic environment potentially affected by the development of renewable resources on federal land encompasses Arizona, irrespective of land ownership. Where available, socioeconomic information is provided for both Arizona and for the U.S. Measures of economic development and social indicators described in the following sections include employment, unemployment, personal income, population, sales tax revenues, and housing. For each indicator, the most recently available data are presented; forecasts are also presented as available. Data were collected from the U.S. Census Bureau, the U.S. Department of Labor, Bureau of Labor Statistics (BLS), and various state agencies. Information is also provided for current land uses on public lands within Arizona.

State Employment Levels and Projections

There were 2,855,660 jobs in Arizona in 2008. **Table 3-11**, Occupational Levels and Projections in Arizona (2008-2018), provides the 2008 employment levels and 2018 employment projections by Standard Occupation Classification (SOC), which were developed by the BLS. Office and administrative support represented the largest SOC in 2008, with 508,978 total estimated jobs. Other significant SOCs included sales and related occupations, with 306,370 total estimated jobs. SOCs of potential relevance to public lands include construction and extraction, which accounted for 203,889 jobs (10.7 percent), and farming, fishing, and forestry, which accounted for 16,948 jobs (0.6 percent) (AZ DOC [Arizona Department of Commerce] & BLS 2010). The projected increase for all SOCs between 2008 and 2018 is 158,476 jobs, an increase of 5.5 percent (AZ DOC & BLS 2010). Projections for some SOCs, are anticipated to decrease, notably construction and extraction (8.1 percent decrease).

State Unemployment

Between 2001 and 2011, the annual average number of jobs in Arizona ranged from a low of 2,589,800 in 2001 to a high of 3,179,503 in 2011. **Table 3-12,** Unemployment Levels in Arizona (2001-2011), provides total unemployment

Table 3-11
Occupational Levels and Projections in Arizona (2008-2018)

SOC (Standard Occupation Classification)	Employment		10-Year Change (%)	
	2008 Estimated	2018 Projected	Number	Percent
Total, All Occupations	2,855,660	3,014,136	158,476	5.5%
Management	168,202	168,158	-44	0.0%
Business and Financial Operations	137,844	151,434	13,590	9.9%
Computer and Mathematical	63,180	67,675	4,495	7.1%
Architecture & Engineering	58,560	61,259	2,699	4.6%
Life, Physical, & Social Science	24,160	26,314	2,154	8.9%
Community & Social Services	34,688	38,078	3,390	9.8%
Legal	21,144	22,444	1,300	6.1%
Education, Training & Library	151,321	166,257	14,936	9.9%
Art, Design, Entertainment, Sports, & Media	40,443	42,014	1,571	3.9%
Healthcare Practitioners & Technical	132,114	159,025	26,911	20.4%
Healthcare Support Occupations	70,057	87,345	17,288	24.7%
Protective Service	79,141	84,668	5,527	7.0%
Food Preparation & Serving Related	229,663	256,898	27,235	11.9%
Building & Grounds / Cleaning & Maintenance	118,447	121,365	2,918	2.5%
Personal Care & Service	91,485	100,006	8,521	9.3%
Sales & Related	306,370	322,497	16,127	5.3%
Office & Administrative Support	508,978	537,339	28,361	5.6%
Farming, Fishing, & Forestry	16,984	17,120	136	0.8%
Construction & Extraction	203,889	187,362	-16,527	-8.1%
Installation, Maintenance, & Repair	112,242	114,314	2,072	1.8%
Production	128,628	123,825	-4,803	-3.7%
Transportation & Material Moving	158,120	158,739	619	0.4%

Source: AZ DOC & BLS 2010

Total average annual openings are the sum of openings from growth plus openings from separations. Separations are vacancies caused by workers leaving the labor market or changing occupations. Thus, an occupation that is not growing or is in decline could still have openings due to separations.

Some occupations are suppressed due to confidentiality or base employment less than 50.

Table 3-12
Unemployment Levels in Arizona (2001-2011)

Year	AZ Labor Force (Annual Average)	AZ Unemployment (Annual Average)	AZ Unemployment Rate (Annual Average)
2001*	2,589,800	122,018	4.7%
2002*	2,671,546	160,574	6.0%
2003*	2,721,477	156,008	5.7%
2004*	2,780,643	138,622	5.0%
2005*	2,859,352	133,693	4.7%
2006*	2,957,468	121,533	4.1%
2007*	3,018,323	113,667	3.8%
2008*	3,117,136	183,711	5.9%
2009*	3,157,694	305,536	9.7%
2010*	3,175,724	316,103	9.9%
2011**	3,179,503	300,210	9.4%

Source: BLS 2011a
Note: Unemployment rates are not seasonally adjusted.
*Reflects revised population controls, model re-estimation, and new seasonal adjustment
**Preliminary (through June 2011)

levels for Arizona between 2001 and 2011. Unemployment in Arizona has increased over the past five years, following national trends observed in the recent economic downturn. Unemployment levels have ranged from a low of 113,667 in 2007 to a high of 316,103 in 2010. It is important to consider that population has increased every year between 2001 and 2011; the overall number of unemployed people must be compared to the overall state population to provide adequate context (BLS 2011a). Arizona's lowest levels of unemployment between 2001 and 2011 were in 2006 (4.1 percent) and 2007 (3.8 percent). Arizona's highest levels of unemployment were in 2009, 2010, and 2011 (9.7 percent, 9.9 percent, and 9.4 percent, respectively) (BLS 2011a).

Personal Income

Personal income levels in Arizona are provided in **Table 3-13,** Labor and Non-Labor Income in Arizona (2009). Personal income for the state was over $222 billion in 2009, while the U.S. totals $12 trillion. In Arizona, $138 billion (62 percent) came from net income labor earnings, while $85 billion (38 percent) came from non-labor income sources, including dividends, interest, rent, personal transfer receipts, and other sources. These percentages are similar to those seen for the U.S. (Headwaters Economics 2011).

Table 3-13
Labor and Non-Labor Income in Arizona (2009)

Area	Personal Income Total (Thousands of 2010 $)	Labor income (net earnings)		Non-labor income[1]	
		Thousands of $	Percent of Personal Income Total	Thousands of $	Percent of Personal Income Total
Arizona	222,618,742	137,616,413	61.8%	85,002,329	38.2%
U.S.	123,677,188,140	7,971,951,464	64.5%	4,395,767,376	35.5%

Source: Headwaters Economics 2011
[1]Non-labor income includes dividends, interest, rent, and personal transfer receipts. Non-labor income and labor earnings may not add to total personal income because of adjustments made by the Bureau of Economic Analysis to account for contributions for social security, cross-county commuting, and other factors.

Population

Arizona's population increased at a faster rate than the population of the U.S. during each decade between 1980 and 2010. **Table 3-14**, Arizona Population Totals (1980-2010), provides population data for Arizona and for the U.S.

Table 3-14
Arizona Population Totals (1980–2010)

Location	1980	1990	1980–1990 Percent Change	2000	1990–2000 Percent Change	2010	2000–2010 Percent Change	1980–2010 Percent Change
Arizona	2,716,546	3,665,228	+34.9%	5,130,632	+40.0%	6,392,017	+24.6%	+135.3%
U.S.	226,548,632	248,709,873	+9.8%	281,424,906	+13.2%	308,745,538	+9.7%	+36.3%

Source: U.S. Census Bureau 1980, 2000a, 2000b, 2000c, 2010a

Between 1980 and 1990, Arizona's population increased by nearly one million people, or almost 34 percent. Between 1990 and 2000, Arizona's population increased by 1.5 million people, or nearly 40 percent.

From 2000 to 2010, Arizona's population increased at a smaller rate but still experienced an increase of almost 25 percent (about 1.3 million people). Between 1980 and 2010, the population of the state increased by 135 percent, while the population of the United States increased by 36 percent (U.S. Census Bureau 1980, 2000a, 2000b, 2000c, 2010a). Increased population growth creates heightened demand for natural resources, increased use of public lands, and increased energy demand.

Sales Tax Revenue

Sales tax plays an important role by bringing in revenue to local governments. **Table 3-15**, Net Taxable Sales, Fiscal Year (FY) 2005 through FY 2009, examines the primary sources of sales tax in Arizona from FY 2005-06 to FY 2009-10. Compared with other forms of sales tax, retail sales tax provides the

Table 3-15
Net Taxable Sales, Fiscal Year 2005 through Fiscal Year 2009

Classification	FY 2005-06 (Total Dollar Amount / %Total)	FY 2006-07 (Total Dollar Amount / %Total)	FY 2007-08 (Total Dollar Amount / %Total)	FY 2008-09 (Total Dollar Amount / %Total)	FY 2009-2010 (Total Dollar Amount / %Total)
Mining Severance	$1.22 billion 1.12%	$1.74 billion 1.51%	$1.75 billion 1.56%	$729 million 0.76%	$1.16 billion 1.33%
Utilities	$7.68 billion 7.06%	$8.61 billion 7.47%	$9.24 billion 8.23%	$9.24 billion 9.59%	$9.35 billion 10.70%
Communications	$3.22 billion 2.96%	$3.51 billion 3.05%	$3.67 billion 3.27%	$2.93 billion 3.04%	$3.62 billion 4.14%
Restaurants and Bars	$8.94 billion 8.22%	$9.62 billion 8.34%	$9.66 billion 8.61%	$9.09 billion 9.44%	$9.02 billion 10.32%
Amusements	$999 million 0.92%	$1.09 billion 0.94%	$1.15 billion 1.02%	$1.05 billion 1.09%	$1.05 billion 1.20%
Personal Property Rentals	$3.63 billion 3.34%	$3.93 billion 3.41%	$4.00 billion 3.56%	$3.55 billion 3.69%	$3.13 billion 3.58%
Contracting	$20.5 billion 18.85%	$22.4 billion 19.44%	$20.2 billion 17.95%	$14.9 billion 15.45%	$9.31 billion 10.65%
Retail	$53.1 billion 48.89%	$55.0 billion 47.72%	$52.6 billion 46.86%	$46.2 billion 47.94%	$42.9 billion 49.08%
Hotel/Motel	$2.27 billion 2.09%	$2.41 billion 2.09%	$2.41 billion 2.14%	$2.12 billion 2.20%	$1.95 billion 2.23%
Use Tax	$6.16 billion 5.66%	$6.09 billion 5.28%	$6.84 billion 6.09%	$5.88 billion 6.11%	$5.46 billion 6.25%
Other[1]	~$968 million 0.89%	~$865 million 0.75%	~$797 million 0.71%	~$665 million 0.69%	~$455 million 0.52%
State Total[2]	*$109 billion* *100%*	*$115 billion* *100%*	*$112 billion* *100%*	*$96.3 billion* *100%*	*$87.4 billion* *100%*

Source: AZ DOR 2010
[1]Other sources of sales tax that are not listed include Transporting, Mining (Oil & Gas), Private Car and Pipelines, Publishing, Job Printing, Commercial Lease, Rental Occupancy Tax, Use Tax-Utilities, and Membership Camping. These sources of sales tax are below 1% of state total sales taxes for each fiscal year, and their combined monetary values for each fiscal year are approximate, as they are calculated as (% of Total) multiplied by (State Total).
[2]Figures may not add to total due to rounding.

most revenue to the state. In FY 2006-07, retail sales tax provided $55 billion, or 48 percent of the overall sales tax for the state. In FY 2009-10, retail sales

tax generated $43 billion, which is the lowest monetary value for all fiscal years (FY 2005-06 to FY 2009-10), but the highest percentage of overall sales tax (49 percent) (AZ [Arizona Department of Revenue] DOR 2010).The second most significant source of sales tax is the Contracting classification, which provided a low of 11 percent of the state's sales taxes in FY 2009-10, and high of 19 percent in FY 2006-07 (AZ DOR 2010).

Overall, sales taxes ranged from a high of $115 billion in FY 2006-07 to a low of $87 billion in FY 2009-10 (AZ DOR 2010).

Housing Data

Arizona experienced a housing boom in the past decade. Between 2000 and 2009, there was a 21.4 percent increase in the number of housing units (compared with 10.2 percent for the U.S.) (U.S. Census Bureau 2000a, 2009). Housing prices in the state were dramatically increasing and peaked in 2006. Because of the recent economic downturn, however, prices are now at or below 2000 levels for many metropolitan areas (Zillow 2011).

Median home value, according to 2009 estimates, was $218,400, which was higher than the U.S. average of $185,400. The vacancy rate for Arizona houses in 2009 was 15.4 percent, which was higher than the U.S. average of 11.8 percent. Refer to **Table 3-16**, Arizona Household Characteristics (2000 to 2005-2009 Comparison).

Table 3-16
Arizona Household Characteristics (2000 to 2005-2009 Comparison)

		State of Arizona	United States
Average Household Size (persons)	2000	2.64	2.59
	2009*	2.76	2.60
Total Housing Units	2000	2,189,189	115,904,641
	2009*	2,657,551	127,699,712
Housing Units % Change 2000–2009*		21.4%	10.2%
Occupied Housing Units	2000	1,901,327	105,480,101
	2009*	2,248,170	112,611,029
Vacant Housing Units	2000	287,862	10,424,540
	% Vacant 2000	13.1	9.0%
	2009*	409,381	15,088,683
	% Vacant 2009*	15.4%	11.8%
Median Value (Owner-occupied Homes)**	2000	$121,300	$119,600
	2009*	$218,400	$185,400

Source: U.S. Census Bureau 2000a, 2009
*Data for 2009 represent 2005–2009 estimates
**Number represents median value of single-family owner-occupied homes

Current Land Uses

Current significant uses of public land in the planning area include recreation, mineral and energy development, and grazing.

Recreation

Recreation on public lands in the planning area consists of a large variety of activities, including off OHV use, biking, and hiking. Additional details for recreation are included in **Section 3.15**, Recreation. Recreation on public lands provides funds directly through recreation permit fees, and indirectly through money spent by visitors in the local communities. Public lands attract visitors from within the state and from around the world. In 2009, Arizona hosted 35.3 million domestic and international overnight visitors, equal to roughly 97,000 visitors per day (Arizona Office of Tourism 2009). In 2009, residents from other states (21.2 million visitors) made up the largest share of overnight visitors (60 percent) to Arizona, while nearly 5 million international visitors represented about 14 percent of Arizona's overnight visitation. Travel is an important contributor to the vitality of both state and local economies. In 2009, total direct travel spending in Arizona was $16.6 billion, which generated 157,200 direct jobs, paying $4.7 billion in earnings (Arizona Office of Tourism 2009). Additional indirect spending is generated from income brought into the local economies due to travel spending.

Mineral and Energy Development

Arizona ranked first in nonfuel mineral production in the U.S. In addition to leading the U.S. in copper, Arizona ranks in the top five in molybdenum, sand and gravel, gemstones, perlite, silver, zeolites, and pumice (Singh 2008). In 2008, total value of mineral resources was approximately $7.58 trillion. Additional details are provided in **Section 3.5**, Energy and Minerals. Renewable energy on public lands in Arizona represents a growing contribution to the state economy.

Grazing

Grazing represents a traditional use of land in the West, with some contribution to the state economy in the present day. Grazing on BLM lands has direct effects in terms of employment and income, as well as induced effects in the local economy such as the activities of other businesses required to support ranching operations and the local effects of spending the additional income derived from grazing on public lands. Approximately 100 direct jobs and a total of 191 direct, indirect, and induced jobs were provided by BLM-managed grazing activities in Arizona in 2010 (DOI 2011). Total economic output for grazing on BLM lands was estimated at 14.3 million dollars in direct contributions and 27.4 million dollars in direct, indirect, and induced funds (DOI 2011).

Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," formally requires federal agencies to incorporate environmental justice as part of their missions.

Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

Guidance for evaluating environmental justice populations is included in the BLM planning handbook (BLM 2005c). Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies. It focuses on environmental hazards and human health to avoid disproportionately high and adverse human health or environmental effects on minority and low-income populations.

The evaluation of impacts to environmental justice populations has three steps: 1) describing the geographic distribution of low-income and minority populations in the affected area; 2) assessing whether the impacts of construction and operation would produce impacts that are high and adverse; and 3) if impacts are high and adverse, determining whether these impacts disproportionately affect minority and low-income populations.

Low-income populations are defined as persons living below the poverty level based on total income of $11,136 for an individual and $22,314 for a family household of four for 2010, based on preliminary data (U.S. Census Bureau 2010a). Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and other non-White persons are defined as minority populations.

Table 3-17, Population by Race/Ethnicity, shows the ethnic composition of the total population in Arizona based on 2000 census data, 2010 U.S. Census Bureau estimates, and CEQ guidelines. Individuals identifying themselves as Hispanic or Latino are included in the table as a separate entry. However, because Hispanics can be of any race, this number includes individuals also identifying themselves as being part of one or more of the population groups listed in the table.

Approximately 41 percent of the population in Arizona is classified as minority; the state percentage of minority individuals does not exceed the national average by 20 percentage points or more or 50 percent of the total population, meaning that the state does not have a minority population according to CEQ guidelines. Likewise, the proportion of low-income individuals does not exceed the national average by 20 percentage points and does not exceed 50 percent of the total population, meaning that there is not a low-income population, according to CEQ guidelines (**Table 3-18**, Poverty Level). Location-specific analysis would be conducted prior to project-specific permitting and development. Additional data for project area minority and low-income populations are included in the Socioeconomic Baseline Assessment Report prepared for this project (BLM 2012b).

Table 3-17
Population by Race/Ethnicity

Population	Arizona 2000	Arizona 2010	U.S. 2010
Hispanic or Latino ethnicity of any race	25.3%	29.6%	16.3 %
White	77.9%	73.0%	72.4%
Black or African American	3.6%	4.1%	12.6%
American Indian or Alaskan Native	5.7%	4.6%	0.9%
Asian	2.3%	2.8%	4.8%
Native Hawaiian and Other Pacific Islander	.3%	.2%	.2%

Source: U.S. Census Bureau 2000a, 2011
Note: The sum of the five race groups adds up to more than the total population because individuals may report more than one race.

Table 3-18
Poverty Level (2000 to 2005-2009 Comparison)

Income		Arizona	US
Families Below Poverty Level	2000*	9.9%	9.2 %
	2009	11.6%	11.1 %

Source: U.S. Census Bureau 2000a, 2010a
Data from 2000 census in 1999 dollars
*Data for 2009 represents 2009 estimates

3.16.2 Agua Caliente Solar Energy Zone Affected Environment

Renewable Energy Socioeconomic Overview

The proposed Agua Caliente SEZ is in Yuma County. Yuma County is home to some of the highest incidences of solar radiation in the U.S., and the county has already attracted significant interest in the development of solar energy. One example of an existing solar facility and the scale of its economic impacts is First Solar's Agua Caliente solar facility. The development of this facility is providing a substantial source of employment and associated revenue to the state and local economy. This 290-MW photovoltaic facility provided 534 direct jobs in July 2011 during the construction phase of the project. Of these jobs, 435 were Arizona residents, and 260 live in Yuma County (First Solar 2011).

Socioeconomic Conditions

The proposed Agua Caliente SEZ is located in the eastern portion of Yuma County in an area that is sparsely populated with limited economic development opportunities. Yuma County refers to this portion of the county as the Dateland / East County planning area. Dateland is the largest community in the planning area and is located at the interchange of Avenue 64E and Interstate-8. While some impacts of development would be likely to be distributed throughout neighboring counties and the state as a whole, details are provided for Yuma County and for the Dateland area in particular.

Yuma County Employment and Unemployment Levels

The labor force of Yuma County increased every year between 2001 and 2010. Refer to **Table 3-19**, Employment Levels in Yuma County (2001-2010). The total labor force of Yuma County had an increase of 41.3 percent (from almost 65,000 workers to nearly 92,000 workers) between 2001 and 2010. Yuma County experienced its highest level of unemployment in 2010, with over 25 percent of the workforce (23,166 people) unemployed. Between 2001 and 2005, the unemployment rate remained relatively consistent. The lowest year of unemployment occurred in 2007, at 13.8 percent.

Table 3-19
Employment Levels in Yuma County (2001-2010)

			Unemployed	
Year	**Labor Force**	**Employed**	**Level**	**Rate**
2001	64,884	54,163	10,721	16.5
2002	68,906	57,330	11,576	16.8
2003	72,634	60,426	12,208	16.8
2004	73,477	61,995	11,482	15.6
2005	75,478	63,459	12,019	15.9
2006	76,651	65,489	11,162	14,6
2007	78,263	67,453	10,810	13.8
2008	84,146	69,287	14,859	17.7
2009	88,268	68,423	19,845	22.5
2010	91,707	68,541	23,166	25.3
2001-2010 %Increase	41.3%	n/a*	n/a*	n/a*

Source: BLS 2011b
Estimates use Local Area Unemployment Statistics (LAUS) Methodology. The LAUS program is a Federal-State cooperative effort in which monthly estimates of total employment and unemployment are prepared for approximately 7,300 areas.

Yuma County Employment by Industry

Table 3-20, Yuma County Occupational Levels, provides data regarding estimated 2010 occupation levels, as classified by the U.S. Department of Labor, Bureau of Labor Statistics, SOC system. In May 2010, there were 55,720 jobs in Yuma County. The office and administrative support sector provided the largest number of jobs (8,110 total estimated jobs, or 14.6 percent of the employed). Other sectors with significant levels include farming, fishing, and forestry (13.3 percent of the employed); sales and related (9.6 percent of the employed); and food preparation and serving related (7.9 percent of the employed) (BLS 2011c, 2011d). It should be noted that the SOC data in **Table 3-20**, Yuma County Occupational Levels, excludes military-specific occupations as well as the

Table 3-20
Yuma County Occupational Levels (May 2010)

SOC (Standard Occupation Classification)	Employment	
	May 2010 Estimated*	Percentage
Total, All Occupations	55,720	100%
Management	2,010	3.6%
Business and Financial Operations	1,750	3.1%
Computer and Mathematical	650	1.2%
Architecture & Engineering	1,280	2.3%
Life, Physical, & Social Science	320	0.6%
Community & Social Services	990	1.8%
Legal	180	0.3%
Education, Training, & Library	3,530	6.3%
Art, Design, Entertainment, Sports, & Media	630	1.3%
Healthcare Practitioners & Technical	2,180	3.9%
Healthcare Support Occupations	1,320	2.4%
Protective Service	2,970	5.3%
Food Preparation & Serving Related	4,380	7.9%
Building & Grounds / Cleaning & Maintenance	1,850	3.3%
Personal Care & Service	1,120	2.0%
Sales & Related	5,350	9.6%
Office & Administrative Support	8,110	14.6%
Farming, Fishing, & Forestry	7,380	13.3%
Construction & Extraction	2,160	3.9%
Installation, Maintenance, & Repair	2,500	4.5%
Production	2,020	3.6%
Transportation & Material Moving	3,060	5.5%

Source: BLS 2011c, 2011d
The Occupational Employment Statistics (OES) table above excludes Military-Specific Occupations, as well the majority of the agricultural sector, with the exception of logging (NAICS 113310), support activities for crop production (NAICS 1151), and support activities for animal production (NAICS 1152). Total average annual openings are the sum of openings from growth plus openings from separations. Separations are vacancies caused by workers leaving the labor market or changing occupations. Thus an occupation that is not growing or is in decline could still have openings due to separations. Some occupations suppressed due to confidentiality or base employment less than 50.
*Estimates for detailed occupations do not sum to the totals because the totals include occupations not shown separately. Estimates do not include self-employed workers.

majority of the agricultural sector, with the exception of logging, support activities for crop production, and support activities for animal production.

The agricultural sector drives the economy in the Dateland/East County planning area; jobs in other industries are largely created to support workers in the agricultural sector, based on 2000 census data.

Military Presence in Yuma County: Employment Levels and Economics

The military is a significant source of employment in Yuma County. For every 1,000 civilian jobs in the county in 2010, there were 66 military jobs. In contrast, for every 1,000 civilian jobs in the state in 2008, there were 9 military jobs (Yuma County 2010).

The U.S. Army Yuma Proving Ground (YPG) serves as a major test range specializing in tank-automotive, munitions and weapons, aircraft armament, air delivery systems, and desert environmental. The YPG employs nearly 3,000 military, civilian, and contract employees, as well as people who come to the proving ground for training. The YPG is a major employer in Yuma County and plays an important role in the economic stability of the area. Annual payroll is about $164 million. In addition, YPG commands about $164 million in private contracts.

The Marine Corps Air Station (MCAS) Yuma has approximately 5,500 marines and sailors on any given day. There are several hundred permanent civilian employees and contract employee at MCAS. The economic impact of MCAS on the local community (2002) was $265.7 million (Yuma County Chamber of Commerce 2009).

Yuma County Income Distribution and Poverty Levels

In 2000, the median household income in Yuma County, at $32,182, was below the median household income for Arizona ($40,558) and for the U.S. ($41,994). **Table 3-21**, Yuma County Income Distribution Comparison (2000 to 2005-2009), conveys data regarding income distribution and poverty levels. In 2000, per capita income in Yuma County ($14,802) fell below the levels for the state ($20,275) and for the U.S. ($21,587). In 2000, 15.5 percent of families and 19.2 percent of all people in Yuma County were below the poverty level. The poverty levels for Yuma County were higher than those for Arizona and for the U.S. by at least 5 percent (U.S. Census Bureau 2000a, 2009, 2011).

In 2009, Yuma County's income distribution and poverty levels were similar to 2000 levels, which reflect an overall trend that Yuma County is poorer than the state and the U.S.

Table 3-21
Yuma County Income Distribution Comparison (2000 to 2005-2009)

Income		Yuma County	Arizona	U.S.
Median Household Income	2000	$32,182	$40,558	$41,994
	2009*	$38,854	$50,296	$50,221
Per Capita Income	2000	$14,802	$20,275	$21,587
	2009*	$18,244	$25,203	$27,041
Persons Below Poverty Level	2000	19.2%	13.9%	12.4%
	2009*	19.9%	14.7%	14.3%
Families Below Poverty Level	2000	15.5%	9.9%	9.2%
	2009*	16.8%	10.5%	9.9%

Source: U.S. Census Bureau 2000a, 2009, 2011
Data from 2000 census in 1999 dollars
*Data for 2009 represents 2005–2009 estimates in 2009 inflation adjusted dollars

Yuma County had a median household income of $38,854 in 2009, whereas the state had a median household income of $50,296 and the U.S. had a median household income of $50,221. Yuma County's per capita income in 2009 ($18,244) was also below that of the state ($25,203) and the U.S. ($27,041). The number of people below the poverty level in Yuma County increased between 2000 and 2009, for families (by 1.3 percent) and for all people (0.7 percent) (U.S. Census Bureau 2000a, 2011).

Yuma County Population and Projected Population

Yuma County's population grew from 160,026 in 2000 to 195,751 in 2010, a 22.3 percent increase. Arizona's population increased from about 5.1 million to nearly 6.4 million people between 2000 and 2010, a 24.6 percent increase (slightly higher than Yuma County's percent increase). Both Arizona and Yuma County experienced more relative population growth in comparison to the U.S., which increased in population from 281 million in 2000 to nearly 308 million in 2010 (U.S. Census Bureau 2011). For more details, refer to **Table 3-22**, Population Total Comparison (2000-2010). The Dateland / East County planning area is a relatively large area of 861 square miles but only had a population of 1,137 in 2000 (U.S. Census 2000a). Contrary to the county as a whole, this reflects a population drop between 1990 and 2000. More recent data are not available for the area; however, it is likely that this local trend has continued.

Table 3-23, Population Projection Comparison (2015-2050), provides population projections for Yuma County, Arizona, and the U.S. from 2015 to 2050. Yuma County and Arizona are projected to experience population growth at similar rates, with continual population growth at decreasing rates through 2050. Between 2015 and 2050, Yuma County is projected to experience a 53.5 percent population increase (U.S. Census Bureau 2011).

Table 3-22
Population Total Comparison (2000-2010)

Area	2000	2010	2000-2010 Percent Increase
Yuma County	160,026	195,751	22.3%
Arizona	5,130,607	6,392,017	24.6%
United States	281,424,602	308,745,538	9.7%

Source: U.S. Census Bureau 2011

Table 3-23
Population Projection Comparison (2015-2050)

Year	Yuma County		Arizona		U.S.	
	Projected Population	Percent Increase	Projected Population	Percent Increase	Projected Population	Percent Increase
2015	246,260	--	7,915,629	--	325,539,790	--
2020	271,361	+10.2%	8,779,567	+10.9%	341,386,665	4.9%
2025	294,666	+8.6%	9,588,745	+9.2%	357,451,620	4.7%
2030	316,158	+7.3%	10,347,543	+7.9%	373,503,674	4.5%
2035	335,246	+6.0%	11,049,577	+6.8%	389,531,156	4.3%
2040	351,299	+4.8%	11,693,553	+5.8%	405,655,295	4.1%
2045	364,991	+3.9%	12,284,395	+5.1%	422,058,629	4.0%
2050	377,598	+3.4%	12,830,829	+4.4%	439,010,253	4.0%
2015-2050	131,338	+53.3%	4,915,200	+62.1%	113,470,463	34.9%

Source: Arizona State Demographers Office 2006; U.S. Census Bureau 2008

Yuma County Housing Characteristics

Table 3-24, Yuma County Household Characteristic Comparison (2000 to 2005-2009), provides data regarding household size, number of housing units, percent changes in housing units, vacant housing units, and the median value of owner-occupied homes. Between 2000 and 2009, the total number of housing units increased by 17.1 percent in Yuma County, which is a greater rate of increase than the U.S. (10.2 percent) in the same time period, but a lesser increase than Arizona, which experienced a 21.4 percent increase in the total number of housing units (U.S. Census Bureau 2000a, 2009).

The number of occupied housing units increased for Yuma County, Arizona, and the U.S. from 2000 to 2009; in both 2000 and 2009, Yuma County had the highest percentage of vacant housing units. Over 27 percent of housing units in Yuma County were vacant in 2000, whereas just 13.1 percent and 9.0 percent

Table 3-24
Yuma County Household Characteristic Comparison
(2000 to 2005-2009)

		Yuma County	Arizona	U.S.
Average Household Size (persons)	2000	2.86	2.64	2.59
	2009*	2.61	2.76	2.60
Total Housing Units	2000	74,140	2,189,189	115,904,641
	2009*	86,878	2,657,551	127,699,712
Housing Units % Change 2000–2009*		17.1%	21.4%	10.2%
Occupied Housing Units	2000	53,848	1,901,327	105,480,101
	2009*	70,289	2,248,170	112,611,029
Vacant Housing Units	2000	20,292	287,862	10,424,540
	% Vacant 2000	27.4%	13.1%	9.0%
	2009*	16,589	409,381	15,088,683
	% Vacant 2009*	19.1%	15.4%	11.8%
Median Value (Owner-occupied Homes)	2000	$85,100**	$121,300**	$119,600
	2009*	$132,300	$218,400	$185,400

Source: U.S. Census Bureau 2000a, 2009
*Data for 2009 represent 2005–2009 estimates
**Number represents median value of single-family owner-occupied homes

of housing units were classified as vacant in the state of Arizona, and the U.S., respectively, in the same year. In 2009, 16,589 housing units, or 19.1 percent of the housing units in Yuma County, were vacant. In contrast, 15.4 percent of homes in Arizona and 11.8 percent of homes in the U.S. were vacant (U.S. Census Bureau 2000a, 2009).

The median value of owner-occupied homes was lower for Yuma County in 2000 and in 2009 as compared to Arizona and the U.S. In 2000, the median value of an owner-occupied home in Yuma County was $85,100, which is nearly 30 percent less than the median value of an owner-occupied home in Arizona in the same year. In 2009, Yuma County's median value of an owner-occupied home was $132,300, which is 39.4 percent less than the median value of an owner-occupied home for Arizona and 28.6 percent less than the median value of an owner-occupied home for the U.S. (U.S. Census Bureau 2000a, 2009).

Yuma County Educational Trends

Yuma County has high pupil/teacher ratio compared to other counties in Arizona. In the 2000-01 school year, Yuma County averaged 20.70 pupils per each teacher, exceeded only by three other counties in the state (Mohave County had 22.80 pupils per teacher; Navajo County had 21.20 pupils per

teacher; and Santa Cruz County had 22.20 pupils per teacher). Yuma County's pupil-to-teacher ratio was the highest of all 15 counties in Arizona during the 2009-10 school year, with 23.65 pupils per teacher (IES 2011). See **Table 3-25**, Yuma County Data for Pupil/Teacher Ratio (2000-01 to 2009-10).

Table 3-25
Yuma County Data for Pupil/Teacher Ratio (2000-01 to 2009-10)

County	Pupil/Teacher Ratio (School) [2000-01]	Pupil/Teacher Ratio (School) [2005-06]	Pupil/Teacher Ratio (School) [2009-10]
Yuma	20.70	20.80	23.65

Source: IES 2011

Of the approximately 197,000 people living in Yuma County, Arizona, about 68 percent (33,450) are 18 years and older. Of that number, about 29 percent (38,114) lack a high school credential. Of the population 18 and over representing child-bearing and employment ages in Yuma County, 14 percent (18,659) have only an elementary education. Additionally, 12 percent of individuals 18 years and older (15,881) live in "linguistically isolated" households, which means that all members of the household 14 years and older have at least some degree of difficulty with the English language (Arizona Department of Education 2010). Additional strains on the Yuma County educational system could exacerbate strains on the education system within the county.

Yuma County Crime Statistics

Table 3-26, Crime Statistic Comparison, compares crime statistics for Yuma County with crime statistics for Arizona. The 2010 crime rate for Yuma County (2,488 crimes per 100,000 population) was significantly lower than the 2010 crime rate for Arizona (3,910 crimes per 100,000 population). However, violent crimes accounted for a higher percentage of total crimes (13.2 percent violent crimes) than for Arizona (9.5 percent violent crimes).

Table 3-26
Crime Statistic Comparison (2010)

Location	Crime Rate 2010 (Crimes per 100,000 Population)	Violent Crimes as a Total % of the Crime Index**
State of AZ	3,910.2*	9.5%
Yuma County	2,487.9	13.2%

Source: DPS 2010

*The 2010 crime rate for Arizona was 3,910.2 crimes per 100,000 population based on an estimated population of 6,401,758.

**The remaining percentage of crimes (90.5%) was for property crimes in 2010.

Environmental Justice

The county and census tracts (small, relatively permanent statistical subdivisions of a county) surrounding the proposed Agua Caliente SEZ were examined for percentage of low-income and minority populations per CEQ guidelines. Both Yuma County and two census tracts (Census Tract 121 in Yuma County and Census Tract 7233.02 in Maricopa County) have a significant (over 50 percent) minority population predominantly comprised of Hispanic or Latino persons (**Table 3-27**, Population by Race/Ethnicity Comparison). The population therefore meets the CEQ classifications as a minority population that may be impacted by the proposed action.

Table 3-27
Population by Race/Ethnicity Comparison

Geography	Population					
	Hispanic or Latino ethnicity of any race	White	Black or African American	American Indian or Alaskan Native	Asian	Native Hawaiian and Other Pacific Islander
Census Tract 201 La Paz County	25.4%	84.3%	1.0%	2.6%	0.6%	0.1%
Census Tract 205.01 La Paz County	8.1%	94.4%	1.2%	2.2%	0.4%	0.0%
Census Tract 205.02 La Paz County	6.6%	94.5%	0.7%	3.2%	0.4%	0.0%
Census Tract 7233.02 Maricopa County	60.2%	50.1%	1.5%	20.0%	0.7%	0.0%
Census Tract 506.03 Maricopa County	36.1%	73.4%	2.4%	2.7%	0.7%	0.3%
Census Tract 121 Yuma County	53%	76%	4.0%	3.1%	3.3%	.8%
Census Tract 112.02 Yuma County	47.3%	79.2%	1.0%	1.9%	0.7%	0.2%
Yuma County	59.7%	73.8%	2.6%	2.3%	1.9%	0.30%
Arizona	29.6%	73.0%	4.1%	4.6%	2.8%	.20%

Source: US Census Bureau 2010a, 2011

Note: The sum of the five race groups adds to more than the total population because individuals may report more than one race.

The proposed Agua Caliente SEZ area poverty level was also examined (**Table 3-28**, Poverty Level Comparison). Based on 2009 data, Yuma County has 16.8 percent of families below the poverty level. Census tracts within a 25-mile radius of the SEZ were examined. Data are not available for census tracts for 2010. However, 5-year estimates for 2006-2010 indicate that 30.7 percent of families in Census Tract 121 were below the poverty level. While higher than the county and national level, this population does not meet CEQ classifications for a low-income population.

Table 3-28
Poverty Level Comparison

Geography	Families Below Poverty Level
Census Tract 201 La Paz County	15.3%
Census Tract 205.01 La Paz County	8.2%
Census Tract 205.02 La Paz County	4.6%
Census Tract 7233.02 Maricopa County	14.2%
Census Tract 506.03 Maricopa County*	18.3%
Census Tract 121 Yuma County	30.7%
Census Tract 112.02 Yuma County	7.9%
Census Tract 9800.01 Yuma County	NA
Yuma County	16.8%
Arizona*	11.6 %

Source: US Census Bureau 2009
2005-2010 estimate, exceptions noted
**2009, *2000 (2006-2010 data not available)
Note that Census Tract 9800.01 in Yuma County has a population of zero.

3.17 SOIL RESOURCES

3.17.1 RDEP Affected Environment

Soil Taxonomy

Soil formation results from the complex interactions between geologic material, climate, topography, vegetation, organisms, and time. The classification of soils is based on their degree of development into distinct layers or horizons and their dominant physical and chemical properties. Due to the large size of the planning area, soils are described in terms of their soil order, the highest order of classification used by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). Further soil classification includes suborder, great group, subgroup, family, and series. These classifications are based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Additional site-specific information would be provided for project-specific locations prior to site development.

Soil orders that are likely to occur in the planning area, as described by NRCS (NRCS 2011a), are presented below in the general declining order of occurrence in the planning area.

Aridisols

Aridisols are light in color and low in organic material. These soils are characterized by an extreme water deficiency. They may have subsurface accumulations of soluble materials, such as calcium carbonate, silica, gypsum, soluble salts, and exchangeable sodium. Vegetation on these soils includes scattered desert shrubs and short bunchgrasses, which are important forage for livestock. Aridisols are generally not very productive without irrigation and may

be prone to salinity buildup. Subsurface accumulations of soluble materials like calcium carbonate, silica, gypsum, soluble salts, and exchangeable sodium result in hardpans that impede water infiltration. Aridisols in the planning area are found throughout the state in arid and semiarid areas, with the largest concentration in the Sonoran Desert in the southwest as well as on the Colorado Plateau in the northeast (NRCS 2011b). BLM-administered lands in the planning area are dominated by Aridisols, particularly in the Kingman, Lake Havasu, Yuma, and Lower Sonoran Field Offices.

Entisols

Entisols, common in lower elevation arid and semiarid environments, are young, weakly developed mineral soils showing little or no horizon development. These soils include recent alluvium, sands, soils on steep slopes, and shallow soils. Entisols are also formed in recently deposited sediments on floodplains, dunes, fans, and deltas along rivers and small streams. These soils support wildlife habitat and pasture or rangeland, and may support trees in areas of relatively high precipitation. All soils that do not fit into one of the other 11 orders are Entisols. Thus, they are characterized by great diversity, both in environmental setting and land use. Entisols are found throughout the planning area. Concentrations of this soil are seen most dominantly in the Colorado Plateau in the northern and northeastern part of the state as well as scattered throughout the Sonoran Desert and the mountains surrounding the Phoenix area (NRCS 2011b). Entisolson BLM-administered lands are on small patches throughout the planning area, and more dominantly, in the Arizona Strip Field Office.

Alfisols

Alfisols occur in semiarid to moist areas and are characterized by subsurface clay accumulations leached from surface layer and nutrient-rich subsoils. Alfisols are formed under forest or mixed vegetation cover in which clays have accumulated. These soils can support cropland and commercial timberland and have relatively high native fertility. Alfisols are generally found in forested or wooded regions of the planning area, including the Kaibab Plateau in the north and in the mountains along the San Francisco Plateau in the north-central portion of the state (NRCS 2011b). Some Alfisols are found on BLM-administered lands in the Hassayampa Field Office, though Alfisols are not a significant presence on other BLM-administered lands in the planning area.

Mollisols

Mollisols are commonly dark-colored, organic-rich, mineral soils. Mollisols are the soils of grassland ecosystems. They are characterized by a thick, dark surface horizon. This fertile surface horizon, known as a mollic epipedon, results from the long-term addition of organic materials derived from plant roots. The soil is base-rich throughout and highly fertile. These soils support cropland and pasture or rangeland. Mollisols in the planning are predominantly in the Gila Mountains and Nantanes Plateau in the southeast as well as on the San Francisco

Plateau west of Williams. Mollisols are also found on some BLM-administered land in the Safford Field Office (NRCS 2011b).

Inceptisols

Inceptisols occur in a wide range of climates, from semiarid to humid and are generally young mineral soils showing only moderate degrees of soil development and weathering (more than Entisols). Inceptisols develop where the native vegetation is grass, and may occasionally support trees. They are often found on fairly steep slopes, young geomorphic surfaces, and on resistant parent materials. Land use varies considerably; a sizable percentage is found in mountainous areas and support forest growth. In the planning area, Inceptisols are found in sub-humid regions, notably in the San Francisco Peaks near Flagstaff, the Juniper Mountains and Bradshaw Mountains surrounding Prescott, the Sierra Ancha and the Mazatzal Mountains east of Phoenix, and the Pinelena, Santa Catalina, Galiuro, Chiricahua, and Santa Rita Mountains in the south (NRCS 2011b). Some Inceptisols are located on BLM-administered lands in the Tucson Field Office.

Vertisols

Vertisols are clay-rich soils that shrink and swell with changes in moisture content. During dry periods, the soil volume shrinks, and deep, wide cracks form. Soil from upper portions of the soil profile falls into the cracks, causing a churning effect. The soil volume then expands as it absorbs moisture. These shrink/swell and churning actions create serious engineering problems and generally prevent formation of distinct, well-developed horizons in these soils. Areas dominated by Vertisols are associated primarily with volcanic (basalt) rocks in Arizona. They are generally limited to the Antelope Flats near San Carlos in Gila and Graham Counties, as well as areas in the Mohan Mountains in Mohave and Yavapai Counties east of Kingman (NRCS 2011b). Vertisols are not a significant presence on BLM-administered lands in the planning area.

Sensitive Soils

For the purposes of this assessment, sensitive soils include soils with a high potential for supporting biological soil crust, desert pavement, and soils prone to erosion by wind or water. Soil type, the local climate, landscape position, land uses, and vegetation cover all contribute to impacts on sensitive soils.

Biological Soil Crusts

Biological soil crusts, also known as cryptogamic, cryptobiotic, microbiotic, or microphytic soil crusts, are composed of complex communities of cyanobacteria, green algae, bryophytes, lichens, mosses, microfungi, and other bacteria. The filaments produced by these organisms weave through the top few millimeters of soil, forming a matrix that stabilizes and protects soil surfaces from wind and water erosion and retains soil moisture. Biological soil crusts are commonly found in semiarid and arid environments where vascular plant cover is sparse (Belnap et al. 2001). Biological crusts in many regions are best

developed in interspaces between shrubs. Invasive exotic plants generally decrease the biological crust cover in most ecosystems (Belnap et al. 2001). In general, more stable, fine-textured soils (such as silty loams) support greater crustal cover than less stable, coarse-textured soils (Belnap et al. 2001). Biological soil crusts are well adapted to severe growing conditions but are influenced by physical disturbances, fire, and application of herbicides, especially in sandy soils. Disturbance of biological crusts results in decreased soil organism diversity, nutrients, stability, and organic matter. In areas where biological soil crusts are abundant, these changes may increase the rate of soil loss due to surface runoff or wind erosion. Biological soil crusts are found in arid and semi-arid environments. These crusts are common and scattered throughout the planning area in the Sonoran Desert and on the Colorado Plateau (USGS 2011b).

Desert Pavement

Desert pavement consists of a single layer of tightly packed pebbles and small stones, the surface of which is covered with a dark varnish. Extremely fine-grained soils of silt- and clay-sized particles are found beneath the pavement surface. The abundance of coarse particles on desert pavements is thought to be the result of deflation, a process whereby fine sediments are eroded from alluvium by wind or water and/or the upward movement of larger clasts through the alluvial matrix (by cycles of shrinking and swelling and/or freezing and thawing) until they reach the surface (McFadden et al. 1987). Desert pavements form in the most arid parts of the Sonoran Desert, where annual rainfall is less than eight inches on average. Desert pavement is also found in the Mojave Desert. Perennial plants are often absent from these surfaces; instead, the pavements support a sparse seasonal cover of ephemeral species (Turner and Brown 1994). The tightly packed surface of desert pavement inhibits infiltration of precipitation and promotes runoff, which funnels water into the adjacent rills. Desert pavements may play a key role in hydrologic function by funneling surface runoff to nearby wash channels that support trees and other vegetation (Turner and Brown 1994). Desert pavements are less susceptible to disturbance than biological soil crusts, but once they are disturbed, desert pavements lose their armoring function, increasing the likelihood of soil loss due to surface runoff or wind erosion. Desert pavement is found in arid environments. Some of the most extensive and well-developed areas of desert pavements occur on stony alluvial fan deposits flanking the rugged, low mountains in the extremely arid lower Colorado River Valley (Arizona Sonora Desert Museum 2011).

Erodible Soils

The quantity of soil lost by water or wind erosion is influenced by climate, topography, soil properties, vegetative cover, and land use. Erosion occurs when wind or water forces exceed the ability of stabilizing factors to hold the fine-grained components of soil in place. Factors that function to stabilize soils include vegetation cover, biological soil crust cover, rock cover, high salt or calcium carbonate content, high clay and silt content, physical crusts, and desert

pavement. While erosion occurs under natural conditions, rates of soil loss may be accelerated by human activity. Soil stabilizing factors can be compromised by compaction created by vehicles, livestock, and humans, and the loss of fine soil particles reduces the soil's productivity (Belnap et al. 2001).

Soils vary in their susceptibility to erosion. The soil erodibility factor K is a measure of water erodibility for a standard condition. Fine-textured soils high in clay have low K values, about 0.02 to 0.15, because they are resistant to detachment. Coarse texture soils, such as sandy soils, have low K values, about 0.05 to 0.2, because of low runoff even though these soils are easily detached. Medium-textured soils, such as silt loam soils, have moderate K values, about 0.25 to 0.40, because they are moderately susceptible to detachment and they produce moderate runoff. Soils having a high silt content are the most erodible of all soils. They are easily detached and they tend to crust and produce large amounts and rates of runoff. Values of K for these soils tend to be greater than 0.4. In practical terms, the soil erodibility factor is the average long-term soil and response to the erosive powers of rain and wind; that is, the soil erodibility factor is a lumped parameter that represents an average annual value of the soil reaction to a large number of erosion and hydrologic processes. Although a K factor was selected to represent a soil in its natural condition, past management or misuse of a soil by intensive cropping or other factors can increase a soil's erodibility (NRCS 2011c).

The wind erodibility index is a measure of soil (in tons) eroded by wind from an acre of exposed land over a one-year period based on the amount of fine particles in the soil, and ranges from 0 to 310 tons per acre. A wind erodibility group consists of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The soil texture class most vulnerable to wind erosion is sand (very fine sand, fine sand, sand, or coarse sand), a common constituent of exposed sediments in the alluvial basins found in desert ecosystems in the planning area. Wind erosion is also increased in arid and semiarid regions where lack of soil moisture greatly reduces soil's adhesive capability (USGS 2011c). There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction (NRCS 2011c).

Soil particles (soil fines) eroded by wind (as fugitive dust) are a nonpoint source of air pollution with potentially significant health effects and environmental impacts. Likewise, water-eroded soils can impact water quality and negatively impact aquatic habitats. Due to the slow process of replacing soil, the best mitigation to reduce soil loss by erosion is to follow practices that avoid soil disturbance to the maximum extent possible.

Sensitive soils are a concern in the planning area, and on BLM-administered lands in particular, due to the susceptibility of arid soils to contain one or more sensitive soil features. A large portion of BLM lands in the planning area is located within the Sonoran Desert on arid lands, predominated by the Aridosols soil order. These arid soils have the potential to support biological soil crusts and desert pavement as well as have higher susceptibility to wind erosion than other soil orders.

With increased use of public lands in areas with sensitive or otherwise fragile soils, wind and water-driven erosion is increased. As discussed under sensitive soils, above, compaction of soils by recreation, livestock grazing, or other land use also disrupts protective soil crusts and makes soils susceptible to erosion. As recreation use increases in the planning area due to population growth, the potential for soil crust disturbance and erosion is also likely to increase.

Prime and Unique Farmland

The purpose of the Farmland Protection Policy Act (Public Law 97-98, 7 USC 4201) is to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses, and to assure that federal programs are administered in a manner that, to the extent practicable, will be compatible with state and local government and private programs and policies to protect farmland. The term "farmland" includes all land defined as follows:

- Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion, as determined by the Secretary of Agriculture. Prime farmland includes land that possesses the above characteristics but is being used to produce livestock and timber. It does not include land already in or committed to urban development or water storage;
- Unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary of Agriculture. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods; and
- Farmland, other than prime or unique farmland, that is of statewide or local importance for the production of food, feed, fiber, forage, or oilseed crops, as determined by the appropriate state or unit of local government agency or agencies, and that the Secretary of Agriculture determines should be considered as farmland for the purposes of the Farmland Protection Policy Act. Cropland of

> statewide importance is land, in addition to prime farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. Criteria for defining and delineating this land are to be determined by the appropriate state agency or agencies. Generally, additional farmlands of statewide importance include those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods.

The majority of farmland within the planning area is prime or unique farmland. Specific locations of prime and unique farmlands, as well as farmlands of statewide importance, would be discussed for specific lease sites, as farmlands soils are generally identified and managed by local soil conservation districts. As of 1997, there were approximately 675,000 acres of prime farmland in the planning area, primarily located along the Gila River (NRCS 2001).

As development in the planning area has continued to increase, prime farmland acres have decreased. Between 1982 and 2002, approximately 200,000 acres of prime agricultural land was converted to developed land. This trend is expected to continue (Farmland Information Center 2010).

3.17.2 Agua Caliente Solar Energy Zone Affected Environment

The soils in the proposed Agua Caliente SEZ consist of a gravely loam found in an alluvial sediment fan. Soils are dominated by Ligurta-Cristobal complex, 2 to 6 percent slopes, Carrizo very gravelly sand, and Harqua-Tremant Complex with pockets of Cherioni-Rock outcrop complex, 25 to 70 percent slope (**Table 3-29**, Soil Series and Soils Properties in the Proposed Agua Caliente SEZ, and **Figure 3-19**, Soil Series in Proposed Agua Caliente SEZ). Portions of the proposed SEZ located on the Cherioni-Rock outcrop complex have a moderate susceptibility to water erosion due to soil type and slope.

Wind erosion susceptibly for the dominant soil types is low to moderate. Soils with potential for wind erosion include Carrizo very gravelly sand (38 tons/acre/year) and Harqua-Tremant complex (86 tons/acre/year). The proposed SEZ is not classified as prime or unique farmland (NRCS 2011c).

Soil Series in Proposed Agua Caliente SEZ

Soils in the proposed Agua Caliente SEZ are dominated by Ligurta-Cristobal complex, 2 to 6 percent slopes, Carrizo very gravelly sand, and Harqua-Tremant Complex, with pockets of Cherioni-Rock outcrop complex, 25 to 70 percent slopes.

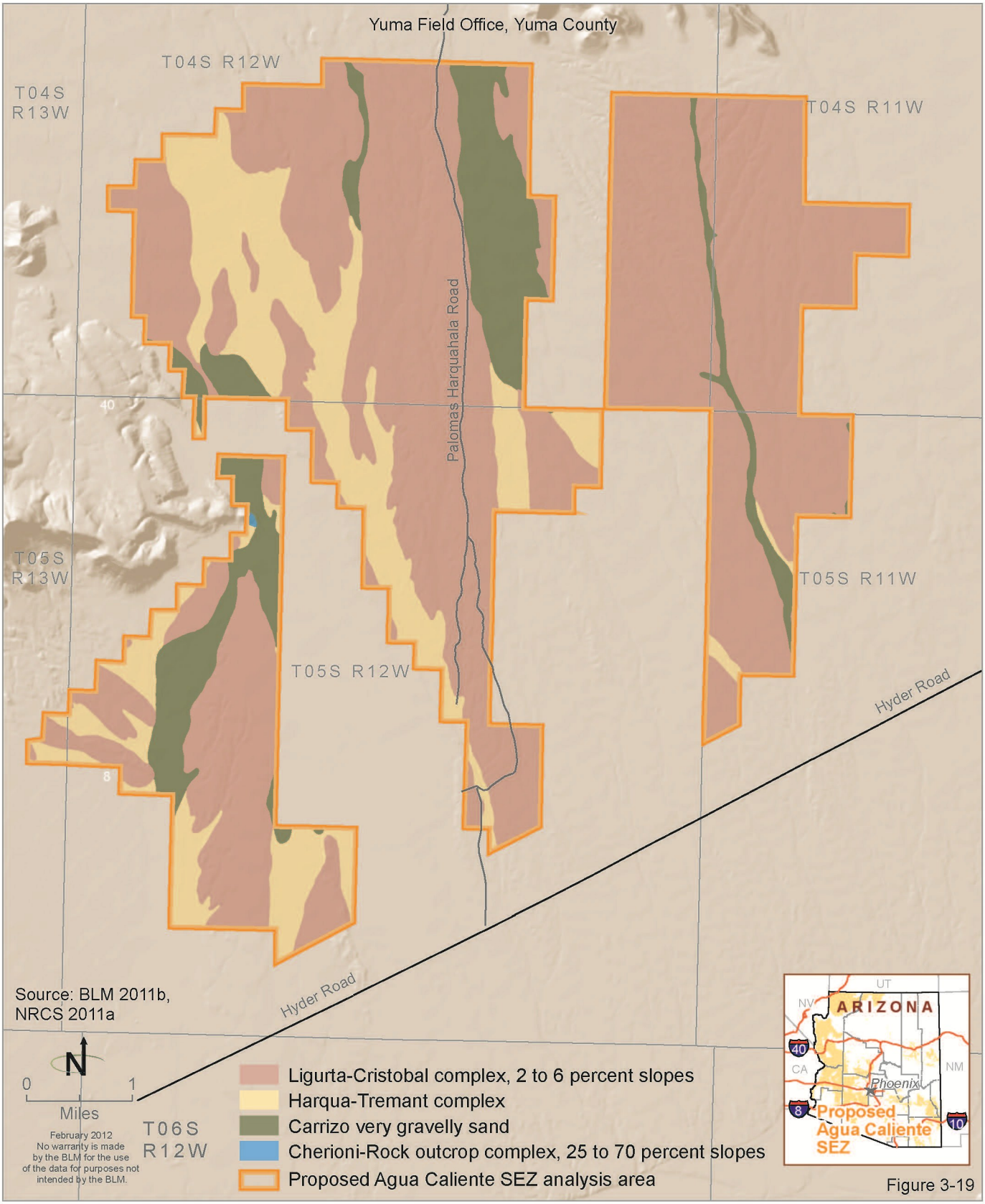


Figure 3-19

Table 3-29
Soil Series and Soil Properties in the Proposed Agua Caliente SEZ

Soil Name	Potential for Water Erodibility (K Factor Rating)	Potential for Wind Erodibility Group/Index (Tons/Acre/Year)	Acres in Proposed SEZ*
Carrizo very gravelly sand	.10	Group 7 / Index 38	2,470
Cherioni-Rock outcrop complex, 25 to 70 percent slopes	.32	Group 8 / Index 0	10
Harqua-Tremant complex	.28	Group 4L / Index 86	3,680
Ligurta-Cristobal complex, 2 to 6 percent slopes	.28	Group 8 / Index 0	14,430

Source: NRCS 2011c, *NRCS 2011d

3.18 SPECIAL DESIGNATIONS

3.18.1 RDEP Affected Environment

The following section describes special designation areas in the planning area, including ACECs, designated wilderness, wilderness study areas (WSAs), streams eligible or suitable for inclusion in the National Wild and Scenic River System, designated wild and scenic rivers, national conservation areas, national monuments, national parks (also see **Section 3.15**, Recreation), backcountry byways, Forest Service roadless areas, and other Forest Service special designation areas (i.e., research natural areas, protection areas, botanical areas, recreation management areas, and wildlife management areas). These special areas have been identified to protect unique characteristics and contain resources that have been identified as scientifically, educationally, or recreationally important.

Special management areas are administered with the intent to improve the manageability of the areas, allowing the managing agency to preserve, protect, and evaluate these significant components of national heritage. Special area designations on public lands can be established by Congress, presidential proclamation, or administratively. The BLM and Forest Service have the authority to identify special management areas through RMP or Forest Plan amendments or revisions.

Congressional designations include Wilderness, National Conservation Areas, rivers in the National Wild and Scenic Rivers System, National Scenic and Historic Trails (discussed in **Section 3.10**, National Trails), and National Parks. National Monuments are designated by presidential proclamation or, less commonly, by congressional designation. In instances where designations occur by an act of Congress or presidential proclamation, the law or order designating each area provides specific objectives and guidelines for that area's management.

At their discretion, both the BLM and Forest Service may apply administrative designations in areas requiring special management. Administrative designations are not legislative. Special areas that are designated administratively by the BLM include ACECs, streams eligible or suitable for inclusion in the National Wild and Scenic River System, and Backcountry Byways. Special areas designated by the Forest Service include Roadless Areas, Research Natural Areas, protection areas, botanical areas, recreation management areas, and wildlife management areas. In addition, for the purposes of analysis in this document, WSAs are also evaluated under administrative designation; however, only Congress can provide additional direction for these areas. Uses are permitted in the administratively designated areas to the extent that the uses are in harmony with the purpose for which the area was designated. The type and number of each special designation area are shown on **Figure 3-15**, Special Designations and listed below in **Table 3-30**, Special Designation Areas in the Planning Area.

Table 3-30
Special Designations in the Planning Area

Special Designation Area	BLM		Forest Service		NPS	
	Number	Acres	Number	Acres	Number	Acres
ACECs[1]	59	788,300	N/A	N/A	N/A	N/A
Wilderness	47	1,391,200	46	2,459,100	0	0
WSAs	2	63,800	N/A	N/A	N/A	N/A
Streams Suitable for Inclusion in the National Wild and Scenic River System	14	268 miles	Unknown	Unknown	Unknown	Unknown
Designated Wild and Scenic Rivers	0	0	2	57.3 miles	0	0
National Conservation Areas	3	121,100	N/A	N/A	N/A	N/A
National Monuments	5	1,775,200	0	0	16	585,800
National Parks	N/A	N/A	N/A	N/A	24	2,587,200
BLM Byways	5	32,300	N/A	N/A	N/A	N/A
Roadless Areas	N/A	N/A	Unknown	3,174,300	N/A	N/A
Other Forest Service Special Designation Areas[2]	N/A	N/A	Unknown	2,392,800	N/A	N/A

Sources: BLM 2011a, 1997

[1]Does not include two ACECs managed by BLM Arizona Field Offices but occurring in California.

[2]Other Forest Service Special Designation Areas include Research Natural Areas, protection areas, botanical areas, recreation management areas, and wildlife management areas.

Notes:

N/A denotes type of special designation area is not designated by agency.

Unknown denotes GIS does not specify a number of areas, only a total GIS acreage.

3.18.2 Agua Caliente Solar Energy Zone Affected Environment

There are no special designation areas within the proposed Agua Caliente SEZ. The Juan Bautista de Anza National Historic Trail is between four and five miles from the proposed Agua Caliente SEZ (see **Section 3.10**, National Trails), and the Sears Point ACEC is 5 and 10 miles from the proposed Agua Caliente SEZ.

The nearest wilderness area, Eagletail Mountains Wilderness, is about 15 miles away from the proposed Agua Caliente SEZ.

3.19 SPECIAL STATUS SPECIES

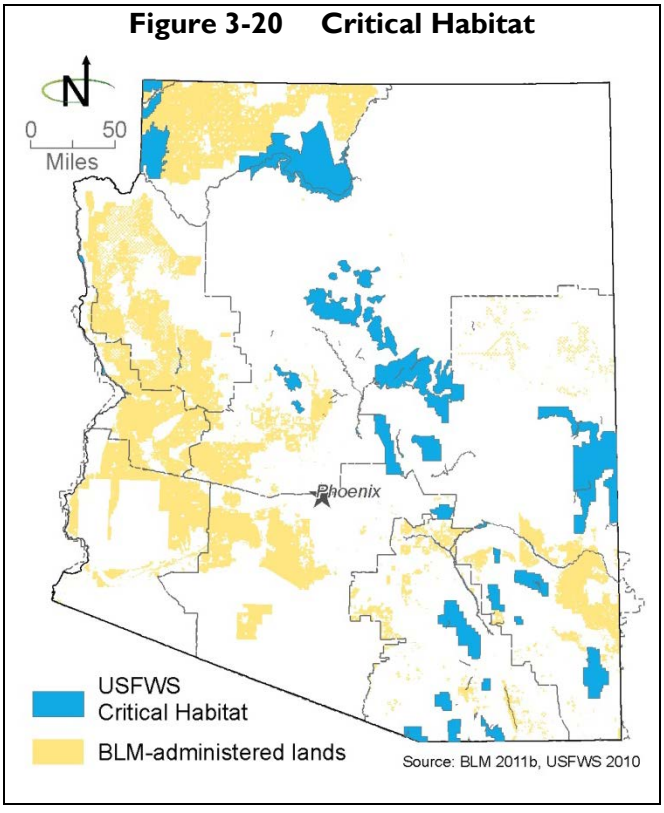
Special status plant and wildlife species are subject to regulations under the authority of federal and state agencies. Descriptions for each category are included below.

3.19.1 RDEP Affected Environment

Federally Listed Species

Federally listed species include those listed by the USFWS as endangered, threatened, proposed, or candidate species under the ESA, Section 4, as amended. Endangered species are those species in danger of extinction throughout all or a significant portion of their range. Threatened species are those species identified by USFWS as likely to become endangered in the foreseeable future. Proposed species are those species recommended for listing under Section 4 of the ESA. Candidate species are those species for which the USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. Candidate species are not protected under the ESA.

Figure 3-20 Critical Habitat



Federally listed species with the potential to occur in the planning area are included in **Table 3-31**, Special Status Animal Species with the Potential to Occur in the Planning Area, and **Table 3-32**, Special Status Plant Species with the Potential to Occur in the Planning Area. In the planning area, 55 animal species and 22 plant species are federally listed as threatened or endangered, proposed for listing, or candidates for listing under the ESA.

Critical habitat for federally listed species is defined under the ESA as specific geographic area(s) essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery. There are approximately 306,000 acres of designated critical habitat on public lands in the planning area. Critical habitat in the planning area is shown on **Figure 3-20**, Critical Habitat.

Table 3-31
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Birds				
American peregrine falcon	*Falco peregrinus anatum*	BLM S, WSC, G4	Open areas with large trees and/or cliffs for nesting sites	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai
American redstart	*Setophaga ruticilla*	WSC, G5	Mature and second-growth wooded habitats	Apache, Yavapai
Arizona Botteri's sparrow	*Peucaea botterii arizonae*	BLM S, G4	Healthy grasslands with interspersed shrubs and trees. Prefers tall grasses for nesting sites	Cochise
Arizona grasshopper sparrow	*Ammodramus savannarum ammolegus*	BLM S, G5	Open desert grassland and Sonoran desert scrub between 3,800 and 5,300 feet	Cochise, Pima, Santa Cruz
Baird's sparrow	*Ammodramus bairdii*	WSC, G4	Grasslands	Cochise, Pima, Santa Cruz
Bald eagle	*Haliaeetus leucocephalus*	BLM S, WSC[2], G5,	Large trees or cliffs near water (reservoirs, rivers, and streams) with abundant prey	Apache[3], Cochise[3], Coconino[3], Gila, Graham, Greenlee[3],La Paz, Maricopa, Mohave, Navajo[3],Pinal, Santa Cruz[3], Yavapai, Yuma
Belted kingfisher	*Megaceryle alcyon*	WSC, G5	Nests in burrows near water	Apache, Coconino, Gila, Graham, Maricopa, Pinal Yavapai
Black-bellied whistling duck	*Dendrocygna autumnalis*	WSC, G5	Riparian areas and near ponds and streams	Cochise, Maricopa, Pima, Pinal, Santa Cruz
Black-billed magpie	*Pica hudsonia*	WSC, G5	Forages in open country; nests in bushes or trees	Apache
Black-capped gnatcatcher	*Polioptila nigriceps*	WSC, G5	Riparian woodland and associated brushy areas, especially mesquite	Cochise, Pima, Santa Cruz
Bobolink	*Dolichonyx oryzivorus*	WSC, G5	Tall grass, flooded meadows, prairie, and agricultural areas	Apache, Gila
Cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*	BLM S, WSC, G5	Dense Sonoran scrub washes	Graham, Maricopa, Pima, Pinal, Santa Cruz, Yuma
California black rail	*Laterallus jamaicensis coturniculus*	BLM S, G4	Marshes along the Colorado River	La Paz, Mohave, Yuma
California condor	*Gymnogyps californianus*	E, G1	High desert canyons and plateaus	Apache, Coconino, Mohave, Navajo, Yavapai
California least tern	*Sterna antillarum browni*	E, G4	Open, bare or sparsely vegetated sand, sandbars, gravel pits, or exposed flats along shorelines of inland rivers, lakes, reservoirs, or drainage systems	Maricopa, Mohave, Pima
Clark's grebe	*Aechmophorus clarkia*	WSC, G4	Herbaceous wetlands and riparian areas, nests in tall plants along bodies of water	La Paz, Mohave

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Birds (continued)				
Common black-hawk	*Buteo gallus anthracinus*	WSC, G4	Riparian areas	Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai
Crested caracara	*Caracara cheriway*	WSC, G5	Paloverde-Saguaro deserts, frequently found near stock tanks.	Pima
Desert purple martin	*Progne subis hesperia*	BLM S, G5	Saguaro cacti	No data
Elegant trogon	*Trogon elegans*	WSC, G5	Open or scrubby woodland, often in pine-oak forest	Cochise, Graham, Pima, Santa Cruz
Ferruginous hawk (breeding population only)	*Buteo regalis*	BLM S, WSC, G5	Healthy grasslands	Coconino, Mohave, Navajo, Yavapai
Gilded flicker	*Colaptes chrysoides*	BLM S, G5	Saguaro cacti	Maricopa, Pinal, Yavapai
Golden eagle	*Aquila chrysaetos*	BLM S, G5	Significant cliffs, large undeveloped areas	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Gray catbird	*Dumetella carolinensis*	WSC, G5	Thickets, dense brushy and shrubby areas	Apache, Cochise
Great egret	*Ardea alba*	WSC, G5	Lakes, rivers, ponds as well as nearby fields and meadows	La Paz, Maricopa, Pinal, Yuma
Least bittern	*Ixobrychus exilis*	WSC, G5	Freshwater marshes with dense, tall growths of aquatic or semi-aquatic vegetation interspersed with clumps of woody vegetation and open water	La Paz, Maricopa, Pinal, Yuma
Le Conte's thrasher	*Toxostoma lecontei*	BLM S, G4	Remote creosote scrub	La Paz, Maricopa, Mohave, Pinal, Pima, Yuma
Masked bobwhite	*Colinus virginianus ridgewayi*	E, WSC, G5	Desert grasslands with diversity of dense native grasses, forbs, and brush	Pima
Mexican spotted owl	*Strix occidentalis lucida*	T, WSC, G3	Nests in canyons and dense forests with multilayered foliage structure	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai
Mississippi kite	*Ictinia mississippiensis*	WSC, G5	A variety of wooded and open areas	Cochise, Graham, Maricopa, Pinal,
Northern Aplomado falcon	*Falco femoralis septentrionalis*	E, WSC, G4	Grassland and savannah	Currently extirpated from AZ with unconfirmed sightings occasionally reported in Cochise County
Northern buff-breasted flycatcher	*Empidonax fulvifrons pygmaeus*	WSC, G4	Pine-oak and riparian areas	Cochise, Pima, Santa Cruz
Northern goshawk	*Accipiter gentilis atricapillus*	BLM S, WSC, G5	Mature or old-growth forests, particularly ponderosa pine	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Mohave, Navajo, Pima, Santa Cruz, Yavapai

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Birds (continued)				
Northern gray hawk	*Buteo nitidus maxima*	WSC, G5	Riparian woodlands near open areas	Cochise, Gila, Graham, Pima, Pinal, Santa Cruz
Osprey	*Pandion haliaetus*	WSC, G5	Nests in trees near water	Apache, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Santa Cruz
Pine grosbeak	*Pinicola enucleator*	WSC, G5	Open coniferous forest	Apache, Coconino, Yavapai
Pinyon jay	*Gymnorhinus cyanocephalus*	BLM S, G5	Healthy pinyon pine forests	No data
Rose-throated becard	*Pachyramphus aglaiae*	WSC, G4	Sycamore dominant riparian areas of south-central Arizona	Pima, Santa Cruz
Snowy egret	*Egretta thula*	WSC, G5	Marshes, lakes, ponds, lagoons	Maricopa, Yuma
Southwestern willow flycatcher	*Empidonax traillii extimus*	E, WSC, G5	Cottonwood/willow and tamarisk vegetation communities along rivers and streams	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Sprague's pipit	*Anthus spragueii*	WSC, G4	Grasslands	Cochise, Santa Cruz
Thick-billed kingbird	*Tyrannus crassirostris*	WSC, G5	Arid scrub, riparian woodland, and open habitats	Cochise, Pima, Pinal, Santa Cruz
Tropical kingbird	*Tyrannus melancholicus*	WSC, G5	Lowlands near water; often nests in cottonwoods	Cochise, Pima, Pinal, Santa Cruz
Veery	*Catharus fuscescens*	WSC, G5	Forests with shrubby understory, nests on the ground at the base of shrubs near water	Apache
Violet-crowned hummingbird	*Amazilia violiceps*	WSC, G5	Scrub, open woodland, and riparian areas	Cochise, Graham, Santa Cruz
Western burrowing owl	*Athene cunicularia hypugaea*	BLM S, G4	Grasslands, undeveloped valley bottoms	Apache, Cochise, Coconino, Graham, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Western snowy plover	*Charadrius alexandrinus nivosus*	WSC, G4	Shores of salt ponds, alkaline lakes and sandy playas	Maricopa
Yellow-billed cuckoo (Western US DPS)	*Coccyzus americanus*	C, WSC, G5	Large blocks of riparian woodlands (cottonwood, willow, or tamarisk galleries)	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Yuma clapper rail	*Rallus longirostris yumanensis*	E, WSC, G5	Fresh water and brackish marshes	Gila, La Paz, Maricopa, Mohave, Pinal, Yuma
Mammals				
Allen's big-eared bat	*Idionycteris phyllotis*	BLM S, G4	Caves, mines	Apache, Cochise, Coconino, Gila, Graham, Mohave, Navajo, Yavapai
American water shrew	*Sorex palustris*	WSC, G5	Near streams with thick overhanging riparian growth	Apache
Arizona myotis	*Myotis occultus*	BLM S, G4	Caves, mines	Apache, Cochise, Coconino, Gila, Greenlee, Mohave, Navajo, Pima, Yavapai

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Mammals (continued)				
Arizona shrew	*Sorex arizonae*	WSC, G3	Conifer forest and oak-pine woodland with thick understory vegetation	Cochise, Santa Cruz
Banner-tailed kangaroo Rat	*Dipodomys spectabilis*	BLM S, G5	Desert grasslands with scattered shrubs, mesquite, or junipers and hard soil to support their deep burrow system	Apache
Black-footed ferret	*Mustela nigripes*	E, WSC, G1	Grassland plains generally found in association with prairie dogs	Apache, Coconino, Navajo, Yavapai
Black-tailed prairie dog	*Cynomys ludovicianus*	BLM S, WSC, G4	Dry, flat, open plains and desert grasslands	Pima
California leaf-nosed bat	*Macrotus californicus*	BLM S, WSC, G4	Caves, mines; lowland desertscrub	Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Camp Verde cotton Rat	*Sigmodon arizonae arizonae*	WSC, G5	Desert areas, usually found within 10 miles of a river, stream or waterway	Yavapai
Cave myotis	*Myotis velifer*	BLM S, G5	Caves, mines	Cochise, Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai
Great western mastiff bat	*Eumops perotis californicus*	BLM S, G5	Caves, mines; rocky canyon country	Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Pima, Pinal, Yuma
Gunnison's Prairie Dog	*Cynomys gunnisoni*	BLM S, G5	High mountain valleys and plateaus at elevations of 6,000 - 12,000 feet; open or slightly brushy country, scattered junipers and pines	Apache, Navajo
Houserock Valley chisel-toothed kangaroo rat	*Dipodomys microps leucotis*	BLM S, G5	Atriplex scrub	Coconino
Hualapai Mexican vole	*Microtus mexicanus hualpaiensis*	E, WSC, G5	Moist, grass/sedge habitats along permanent or semi-permanent waters (springs or seeps)	Coconino, Mohave, Yavapai
Jaguar	*Panthera onca*	E, G3	Found in Sonoran Desert scrub up through subalpine conifer forest	Cochise, Pima, Santa Cruz
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	E, G4	Desert scrub habitat with agave and columnar cacti present as food plants	Cochise, Gila, Graham, Greenlee, Maricopa, Pima, Pinal, Santa Cruz, Yuma
Mexican gray wolf	*Canis lupus baileyi*	E, G4	Chaparral, woodland, and forested areas. May cross desert areas	Apache, Gila, Greenlee, Navajo
Mexican long-tongued bat	*Choeronycteris mexicana*	BLM S, WSC, G4	Caves, mines	Cochise, Coconino, Graham, Pima, Pinal, Santa Cruz
Mount Graham red squirrel	*Tamiasciurus hudsonicus grahamensis*	E, G5	Montane conifer forests from spruce-fir to mixed conifer	Graham

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Mammals (continued)				
Navajo Mexican vole	*Microtus mexicanus navaho*	WSC, G4	Shrub thickets and grassy areas	Apache, Coconino, Navajo
New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	C, WSC, G5	Nests in dry soils but also uses moist, streamside, dense riparian/wetland vegetation	Apache, Greenlee
Ocelot	*Leopardus (=Felis) pardalis*	E, G4	Desert scrub in Arizona. Humid tropical and subtropical forests, and savannahs in areas south of the US.	Cochise, Pima, Santa Cruz
Sonoran pronghorn	*Antilocapra Americana sonoriensis*	E, WSC, G5	Broad intermountain alluvial valleys with creosote-bursage and palo verde-mixed cacti associations	Maricopa, Pima, Yuma
Spotted bat	*Euderma maculatum*	BLM S, WSC, G4	Caves, mines; forages in various habitats, from desert to forested areas	Apache, Coconino, Mohave, Yavapai, Yuma
Townsend's big-eared bat	*Corynorhinus (=Plecotus) townsendii*	BLM S, G4	Caves, mines; forages in desert scrub, oak woodland, pinyon-juniper, and conifer forest habitats	Apache, Cochise, Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Western red bat	*Lasiurus blossevillii*	WSC, G5	Riparian areas	Cochise, Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai
Western yellow bat	*Lasiurus xanthinus*	WSC, G5	Roosts in trees in riparian areas	Cochise, Graham, La Paz, Maricopa, Pima, Pinal, Yuma
Reptiles/Amphibians				
Arizona ridge-nosed rattlesnake	*Crotalus willardi willardi*	WSC, G5	Montane woodlands and canyons, often near streams	Cochise, Santa Cruz
Arizona skink	*Plestiodon "gilberti" arizonensis*	WSC, G5	In and near permanent or semi-permanent streams, in habitats ranging from mesquite riparian drainages up through oak and into pine woodlands	Maricopa, Yavapai
Arizona Striped Whiptail	*Aspidoscelis arizonae*	BLM S, G2	Herbaceous grassland and chaparral shrubland, north end of Wilcox Playa	Cochise, Graham
Arizona treefrog (Huachuca/Canelo DPS)	*Hyla wrightorum*	C, G4	Madrean oak woodlands, savannah, pine-oak woodlands, and mixed conifer forests	Cochise, Santa Cruz
Brown vinesnake	*Oxybelis aeneus*	WSC, G5	Brush covered hillsides, canyons and stream bottoms with sycamore, oak, walnut and wild grape	Pima, Santa Cruz
Chiricahua leopard frog	*Lithobates chiricahuensis*	T, WSC, G3	Pine-oak and oak woodlands and semi-desert grassland with permanent water available	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Navajo, Pima, Santa Cruz, Yavapai

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Reptiles/Amphibians (continued)				
Desert massasauga	*Sistrurus catenatus edwardsii*	WSC, G3	Grassy wetland, rocky hillsides, mesquite/scrub plains, thornbrush, oak-grass, dry prairie, and desert grassland	Cochise
Desert ornate box turtle	*Terrapene ornata*	BLM S, G5	Grassland and herbaceous habitats; also shrubland and chaparral	Cochise, Graham, Pinal, Santa Cruz
Desert tortoise, Mohave population	*Gopherus agassizii (Xerobates)*	T, G4	Mohave desert scrub (north and west of the Colorado River) in basins and bajadas but also found on rocky slopes	Mohave
Desert tortoise, Sonoran population	*Gopherus agassizii*	C, WSC, G4	Upper bajadas and steep slopes in the Sonoran Desert	Cochise, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Flat-tailed horned lizard	*Phrynosoma mcallii*	PT, WSC, G3	Closely associated with creosote-white bursage series of Sonoran Desert, sandy flats or areas with gentle slopes where galleta grass is common	Yuma
Great Plains narrow-mouthed toad	*Gastrophryne olivacea*	BLM S, G5	From mesquite semi-desert grassland to oak woodland, in the vicinity of streams, springs and rain pools	Maricopa, Pima, Pinal, Santa Cruz
Lowland burrowing treefrog	*Smilisca fodiens*	BLM S, WSC, G4	Xeric environments, where it lives in burrows in low open mesquite grasslands	Maricopa, Pima
Lowland leopard frog	*Lithobates yavapaiensis*	BLM S, WSC, G4	Rocky streams in canyons surrounded by conifer forests	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma
Mohave fringe-toed lizard	*Uma scoparia*	BLM S, WSC, G3G4	Sand habitats	La Paz
Narrow-headed garter snake	*Thamnophis rufipunctatus*	WSC, G3G4	Rocky streams with abundant riparian vegetation	Apache, Coconino, Gila, Graham, Greenlee, Navajo, Yavapai
New Mexico ridge-nosed rattlesnake	*Crotalus willardi obscurus*	T, G5	Primarily canyon bottoms in pine-oak communities	Cochise
Northern leopard frog	*Lithobates pipiens*	BLM S, WSC, G5	Near permanent water with rooted aquatic vegetation	Apache, Coconino, Greenlee, Mohave, Navajo, Yavapai
Northern Mexican gartersnake	*Thamnophis eques megalops*	C, G4	Cienegas, stock tanks, large-river riparian woodlands and forests, streamside gallery forests	Apache, Cochise, Coconino, Gila, Graham, Navajo, Pima, Pinal, Santa Cruz, Yavapai
Plains leopard frog	*Lithobates blairi*	BLM S, WSC, G5	In or near water in grassland and oak-pine woodland habitats	Cochise

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Reptiles/Amphibians (continued)				
Relict leopard frog	*Lithobates (Rana) onca*	C, WSC, G1G2	Permanent streams, springs, and spring-fed wetlands with open shorelines and available pools	Mohave
Slevin's bunchgrass lizard	*Sceloporus slevini*	BLM S, G4	Coniferous forest up to 10,000 feet elevation, and rarely desert grassland.	Pima, Santa Cruz
Sonoran Green Toad	*Bufo retiformis*	BLM S, G4	Rain pools, wash bottoms, and areas near water in semi-arid mesquite-grassland, creosotebush desert, and upland saguaro-paloverde desert scrub	Pima, Pinal
Sonoran tiger salamander	*Ambystoma mavortium stebbinsi*	E, WSC, G5 T1	Stock tanks and impounded cienegas; rodent burrows, rotted logs, and other moist cover sites	Cochise, Santa Cruz
Sonoran mud turtle	*Kinosternon sonoriense sonoriense*	BLM S, G4	Riparian habitats	Cochise, Graham, Greenlee, Pima, Pinal
Sonoyta mud turtle	*Kinosternon sonoriense longifemorale*	C, G4	Ponds and streams	Pima
Tarahumara frog	*Lithobates tarahumarae*	WSC, G3	Intermittent rivers and arroyos	Santa Cruz
Tucson shovelnosed snake	*Chionactis occipitalis klauberi*	C, G5	Sonoran Desert scrub; associated with soft, sandy soils having sparse gravel	Maricopa, Pima, Pinal
Western barking Frog	*Craugastor augusti cactorum*	WSC, G5	Rocky areas in oak woodland	Cochise, Gila, Pima, Santa Cruz
Western narrow-mouthed toad	*Gastrophryne olivacea*	WSC, G5	Semi-arid and arid lowlands such as mesquite and shrublands	Maricopa, Pima, Pinal, Santa Cruz
Yuman desert fringe-toed lizard	*Uma rufopunctata*	BLM S, WSC, G3	Sand habitats	Pima, Yuma
Aquatic Species				
Apache (Arizona) trout	*Oncorhynchus gilae apache*	T, WSC, G3	Streams and rivers generally above 6,000 ft. elevation with adequate streamflow and shading; temperatures below 77 degrees F; and substrate composed of boulders, rocks, gravel and some sand and silt	Apache, Coconino, Gila, Graham, Greenlee, Navajo
Beautiful shiner	*Cyprinella formosa*	T, G3	Small to medium sized streams and ponds with sand, gravel, and rock bottoms	Cochise
Bluehead sucker	*Catostomus discobolus*	BLM S, G4	Large rivers and mountain streams	Apache, Coconino
Bonytail chub	*Gila elegans*	E, G1	Warm, swift, turbid mainstem rivers of the Colorado River basin, reservoirs in lower basin	La Paz, Mohave

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Aquatic Species (continued)				
Colorado pikeminnow	*Ptychocheilus lucius*	E, WSC, G1	Warm, swift, turbid mainstem rivers. Prefers eddies and pools	Gila, Maricopa, Yavapai
Desert pupfish	*Cyprinodon macularius*	E, G1	Shallow springs, small streams, and marshes. Tolerates saline and warm water	Cochise, Graham, La Paz, Maricopa, Pima, Pinal, Santa Cruz, Yavapai
Desert sucker	*Catostomus clarki*	BLM S, G3G4	Small to moderately large streams with pools and riffles	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai
Flannelmouth sucker	*Catostomus latipinnis*	BLM S, G3G4	Moderate to large rivers with pools and riffles	Coconino, Mojave
Gila chub	*Gila intermedia*	E, WSC, G2	Pools, springs, cienegas, and streams	Cochise, Gila, Graham, Greenlee, Pima, Pinal, Santa Cruz, Yavapai
Gila topminnow	*Poeciliopsis occidentalis occidentalis*	E, WSC, G3	Small streams, springs, and cienegas vegetated shallows	Cochise, Gila, Graham, La Paz, Maricopa, Pima, Santa Cruz, Yavapai
Gila trout	*Oncorhynchus gilae gilae*	T, G3	Small high mountain streams	Greenlee
Headwater chub	*Gila nigra*	C, G2	Medium-sized streams in large, deep pools often associated with cover such as undercut banks or deep places created by trees or rocks	Gila, Graham, Yavapai
Humpback chub	*Gila cypha*	E, WSC, G2	Large, warm turbid rivers especially canyon areas with deep fast water	Coconino, Mohave
Little Colorado spinedace	*Lepidomeda vittata*	T, WSC, G1G2	Moderate to small streams; found in pools and riffles with water flowing over fine gravel and silt substrate	Apache, Coconino, Navajo
Little Colorado sucker	*Catostomus sp.*	BLM S, WSC, G1G2	Rocky pools and riffles of creeks and small to medium-sized rivers	Apache, Coconino, Navajo
Loach minnow	*Tiaroga cobitis*	T, WSC, G1G2	Benthic species of small to large perennial streams with swift shallow water over cobble and gravel Recurrent flooding and natural hydrograph important	Apache, Cochise, Gila, Graham, Greenlee, Navajo, Pinal
Longfin dace	*Agosia chrysogaster*	BLM S, G4	Shallow sandy and rocky runs in small to medium-sized rivers	Cochise, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai
Mexican stoneroller	*Campostoma ornatum*	WSC, G3G4	Shallow riffles, runs, and pools in small to medium creeks	Cochise
Quitobaquito pupfish	*Cyprinodon eremus*	WSC, G1	Small ponds and streams	Pima

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Aquatic Species (continued)				
Razorback sucker	*Xyrauchen texanus*	E, WSC, G1	Riverine and lacustrine areas, generally not in fast moving water and may use backwaters	Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Pinal, Yavapai, Yuma
Roundtail chub	*Gila robusta*	C, WSC, G1	Cool to warm waters of rivers and streams, often occupy the deepest pools and eddies of large streams	Apache, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pinal, Yavapai
Sonora chub	*Gila ditaenia*	T, WSC, G2	Perennial and intermittent, small to moderate sized streams with boulders and cliffs	Santa Cruz
Sonora sucker	*Catostomus insignis*	BLM S, G3G4	Gravelly or rocky pools of creeks and rivers	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Pinal, Santa Cruz, Yavapai
Speckled dace	*Rhinichthys osculus*	BLM S, G5	Creeks, rivers, springs and streams	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pinal, Santa Cruz, Yavapai
Spikedace	*Meda fulgida*	T, WSC, G2	Medium to large perennial streams with moderate to swift velocity waters over cobble and gravel substrate. Recurrent flooding and natural hydrograph important to withstand invading exotic species	Cochise, Gila, Graham, Greenlee, Pinal, Yavapai
Virgin River chub	*Gila seminuda*	E, WSC, G1	Deep swift waters but not turbulent, occurs over sand and gravel substrates in water less than 86 degrees F. Tolerant of high salinity and turbidity	Mohave
Virgin spinedace	*Lepidomeda mollispinis mollispinis*	BLM S, G1G2	Creeks and small rivers with cool water and pools, runs, and riffles	Mohave
Woundfin	*Plagopterus argentissimus*	E, WSC, G1	Inhabits shallow, warm, turbid, fast-flowing water. Tolerates high salinity	Maricopa, Mohave
Yaqui catfish	*Ictalurus pricei*	T, G2	Moderate to large streams with slow current over sand and rock bottoms	Cochise
Yaqui chub	*Gila purpurea*	E, G1	Deep pools of small streams near undercut banks and debris; pools associated with springheads, and artificial ponds	Cochise

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Aquatic Species (continued)				
Yaqui topminnow	*Poeciliopsis occidentalis sonoriensis*	E, G3	Small to moderate sized streams, springs, and cienegas. Generally found in shallow areas with aquatic vegetation or debris. Tolerates relatively high water temperature and low dissolved oxygen	Cochise
Zuni bluehead sucker	*Catostomus discorbolus yarrowi*	C, G4	Small streams in low velocity, moderate deep pools, and pool-runs with seasonal dense algae Young prefer quieter shallow areas near shoreline	Apache
Invertebrates				
Arizona cave amphipod	*Stygobromus arizonensis*	BLM S, G1	Aquatic habitats in subterranean caves and mine tunnels	Cochise, Santa Cruz
Bylas springnail	*Pyrgulopsis arizonae*	BLM S, G2	Three springs on the north bank of the Gila River, most common on firm substratum in the springbrooks, on dead wood, gravel, and pebbles	Graham
Desert springsnail	*Pyrgulopsis deserta*	BLM S, G2	Small springs along Lower Virgin River	Mohave
Gila tryonia	*Tryonia gilae*	BLM S, G1	Dead wood, leaves, or stones in springs	No data
Huachuca springsnail	*Pyrgulopsis thompsoni*	C, G2	Aquatic areas, small springs with vegetation and slow to moderate flow	Cochise, Santa Cruz
Hydrobiid spring snails	All species in genus *Pyrgulopsis*	BLM S, G1	Springs	No data
Kanab ambersnail	*Oxyloma haydeni kanabensis*	E, G3	Travertine seeps and springs in Grand Canyon National Park	Coconino
Kingman springsnail	*Pyrgulopsis conica*	BLM, S, G1	Burns, Dripping, and Cool Springs in the Black Mountains near Kingman,	Mohave
Page springsnail	*Pyrgulopsis morrisoni*	C, G1	Permanently saturated cienegas, firm substrate like cobble, gravel, woody debris, and aquatic vegetation	Yavapai
San Bernardino springsnail	*Pyrgulopsis bernardina*	C, G1	Springs with firm substrate composed of cobble, gravel, woody debris, and aquatic vegetation	Cochise
Stephan's riffle beetle	*Heterelmis stephani*	C, G1	Free-flowing springs and seeps, commonly referred to as rheocrenes	Santa Cruz
Succineid snails	All species in family *Succineidae*	BLM S, G2	Springs	No data

Table 3-31 *(continued)*
Special Status Animal Species with Potential to Occur in the Planning Area

Common Name	Scientific Name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Invertebrates (continued)				
Three Forks springsnail	*Pyrgulopsis trivialis*	C, G1	Rheocrene springs, seeps, marshes, spring pools, outflows and diverse lotic waters commonly referred to as cienegas	Apache

[1]Status
E- Federally Endangered
T- Federally Threatened
P – Proposed Threatened
C- Candidate for federal listing
BLM S- BLM AZ sensitive species
WSC - Wildlife of Special Concern in Arizona
[2] Wintering and Sonoran Desert populations
[3] Location of wintering population
G1- Critically imparilled
G2- Imparilled
G3- Vunerable
G4- Apparently Secure
G5- Secure
Sources: NatureServe 2011; AZGFD 2011b

Table 3-32
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Acuna cactus	*Echinomastus erectocentrus var. acunensis*	C, HS, G3T1T2Q	Well drained knolls and gravel ridges in Sonoran desert scrub	Maricopa, Pima, Pinal
Ajo rock daisy	*Perityle ajoensis*	SR, G1	Bare rock crevices between 2,600-4,800 feet elevation	Pima
Aquarius milkvetch	*Astragalus newberryi* var. *aquarii*	BLM S, G5T1	Narrow range; on limestone deposits in the Burro Creek area	Mohave, Yavapai
American frog orchid	*Coeloglossum viride* var. *virescens*	SR, G5T5	Found in Hannagan Meadow in mixed aspen and fir forest among ferns between 9,000-10,000 feet elevation	Greenlee
Aravaipa sage	*Salvia amissa*	BLM S, G2	Narrow range; on floodplain terraces in shady canyons	Cochise, Gila, Graham, Pinal
Aravaipa woodfern	*Thelypteris puberula* var. *sonorensis*	BLM S, G5T3	Few scattered springs	Coconino, Graham, Mohave, Pima, Pinal, Yavapai
Arizona agave	*Agave arizonica*	HS, G1Q	Open, rocky slopes and mesas in Sonoran Desert scrub, chaparral, or juniper grassland between 3,600-5,800 feet elevation	Gila, Maricopa, Yavapai

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Arizona bugbane	*Cimicifuga arizonica*	HS, G2	The ecotone between coniferous forest and riparian habitat between 4,700-8,800 feet elevation	Coconino, Gila
Arizona cliff rose	*Purshia subintegra*	E, HS, GNA	White limestone soils derived from tertiary lakebed deposits	Graham, Maricopa, Mohave, Yavapai
Arizona crested coralroot	*Hexalectris spicata* var. *arizonica*	SR, G5T2T4	In oak and conifer woodlands between 3,500-7,000 feet elevation	Cochise, Santa Cruz
Arizona hedgehog cactus	*Echinocereus triglochidiatus* var. *arizonicus*	E, HS, G5T2	Ecotone between interior chaparral and madrean evergreen woodland	Gila, Pinal
Arizona Sonoran rosewood	*Vauquelinia californica* ssp. *sonorensis*	BLM S, G4T1	Relict species in shady canyons	Maricopa, Pima
Arizona willow	*Salix arizonica*	HS, G2G3	Wet areas within subalpine coniferous forest between 7,500-11,700 feet elevation	Apache
Atwood wild-buckwheat	*Eriogonum thompsoniae* var. *atwoodii*	SR, G4T1	Great Basin desert scrub, usually along small drainages between 4,400-4,700 feet elevation	Mohave
Bartram stonecrop	*Graptopetalum bartramii*	BLM S, SR	Narrow range; rocky outcrops in canyons in Madrean Woodland	Cochise, Pima, Santa Cruz
Bigelow onion	*Allium bigelovii*	SR, G3	Grassland, open chaparral, and desert scrub communities between 2,000-5,000 feet elevation	Coconino, Graham, Greenlee, Maricopa, Mohave, Yavapai
Blue diamond cholla	*Opuntia whipplei* var. *multigeniculata*	SR, G4	Flats, valleys, plains, and gentle slopes in grasslands	Mohave
Blue sand lily	*Triteleiopsis palmeri*	BLM S, SR, G3	Sand dunes and sandy soils	Pima, Yuma
Blumer's dock	*Rumex orthoneurus*	HS, G3	Near perennial springs between 6,500-9,000 feet elevation	Apache, Cochise, Coconino, Gila, Graham, Greenlee
Boreal bog orchid	*Platanthera hyperborea*	SR, G5	Wet habitats, almost always associated with skunk cabbage and marsh marigold	Apache, Graham, Greenlee
Brady pincushion cactus	*Pediocactus bradyi*	E, HS, G1	Areas with sparse vegetation characterized by scattered low shrubs and grasses between3,400 - 5,200 feet elevation	Coconino
Broadleaf twayblade	*Listera convallarioides*	SR, G5	In pine and fir forests between 7,000 - 8,600 feet elevation	Coconino, Pima
Button cactus	*Epithelantha micromeris*	SR, G4	Desert scrub and grasslands	Cochise
Cactus apple	*Opuntia engelmannii* var. *flavispina*	SR, G5	Flats, washes, and hillsides in the desert	Maricopa, Pima
California fan palm	*Washingtonia filifera*	SR, G4	Moist areas in desert communities	Yavapai, Yuma
California flannelbush	*Fremontodendron californicum*	BLM S, G4	Relict populations in shady canyons	Gila, Maricopa, Mohave, Pinal, Yavapai
Canelo Hills ladies' tresses	*Spiranthes delitescens*	E, G1	Finely grained, highly organic, saturated soils of cienegas	Cochise, Santa Cruz
Carpet foxtail cactus	*Coryphantha sneedii*	SR, G2	Chihuahuan desert scrub	Cochise

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Catalina beardtongue	*Penstemon discolor*	HS, G2	Openings in pine forests, pine-oak woodlands, and oak woodlands between 4,400-7,200 feet elevation	Cochise, Graham, Pima, Pinal, Santa Cruz
Cerbat beardtongue	*Penstemon bicolor* ssp. *roseus*	SR, G3	Gravel washes and disturbed roadsides to outwash fans and plains between 1,970-5,480 feet elevation	Mohave
Chihuahua breadroot	*Pediomelum pentaphyllum*	BLM S, G1	Open areas in grasslands with burrograss and mesquite	Cochise, Graham
Chiricahua fleabane	*Erigeron kuschei*	SR, G1	Shady, mossy areas around 9,500 feet elevation	Cochise
Chiricahua rock flower	*Apacheria chiricahuensis*	SR, G2	Montane conifer forest and pinyon-juniper woodland	Cochise
Cliff milkvetch	*Astragalus cremnophylax* var. *myriorrhaphis*	SR, G1	On rim-rock benches, cliff ledges and flat-topped pinnacles at the canyon Edge between 6,200-7,900 feet elevation	Coconino
Clifton rock daisy	*Perityle ambrosiifolia*	BLM S, SR, G1	Narrow range; on cliff faces of the Gila Conglomerate	Greenlee
Clustered barrel cactus	*Echinocactus polycephalus* var. *polycephalus*	SR, G3G4	Rocky and gravelly areas in the Sonoran and Mohave deserts between 230-2,787 feet elevation	Coconino, Mohave, Yuma
Cochise pincushion cactus	*Coryphantha robbinsorum*	T, HS, G1	Chihuahuan desert scrub and semidesert grassland between 4,200-4,650 feet elevation	Cochise
Coppermine milkvetch	*Astragalus cobrensis* var. *maguirei*	SR, G4T2	Pinyon-juniper woodland up to 7,000 feet elevation	Cochise
Counter clockwise fishhook cactus	*Mammillaria mainiae*	SR, G3	Sonoran Desert, grasslands, bajadas, valleys, washes, and alluvial fans between 2,000-4,000 feet elevation	Pima
Crested coralroot	*Hexalectris spicata*	SR, G5	In oak and conifer woodlands between 3,500-7,000 feet elevation	Cochise, Pima, Santa Cruz, Yavapai
Dahlia rooted cereus	*Peniocereus striatus*	SR, G4	Flats and small hills in the Sonoran Desert between 0-2,500 feet elevation	Pima
Dalhouse spleenwort	*Asplenium (=Ceterach) dalhousiae*	BLM S, GNR	Cliff face seeps in the Mule Mountains	Cochise, Pima
Desert barrel cactus	*Ferocactus cylindraceus*	SR, G5	Gravelly or rocky areas in the Mohave and Sonoran Deserts between 200-2,900 feet elevation	Coconino, Gila, Maricopa, Pima, Pinal, Yavapai, Yuma
Desert night-blooming cereus	*Peniocereus greggii* var. *transmontanus*	SR, G3G4T3T4	Desert flats and washes between 1,000-4,900 feet elevation	Pima
Diamond Butte milkvetch	*Astragalus toanus* var. *scidulus*	BLM S, G4G5T1T3	Narrow range; in the Moenkopi Formation badlands with red soils	Mohave

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Emory's barrel cactus	*Ferocactus emoryi*	SR, G4	Rocky hills and sandy or rocky flats in desert habitats mostly between 1,400-3,000 feet elevation	Maricopa, Pima
Fallen ladies'-tresses	*Schiedeella arizonica*	SR, GNR	Dry coniferous forest, hillsides, creek canyons between 4,900-13,000 feet elevation	Cochise, Graham, Greenlee, Pima, Santa Cruz
Fickeisen Plains cactus	*Pediocactus peeblesianus var. fickeiseniae*	C, HS, G1G2T1T2	Shallow soils derived from exposed layers of Kaibab limestone. Found on canyon margins, well-drained hills in Navajo Desert, or Great Plains grassland	Coconino, Mohave
Fish Creek fleabane	*Erigeron piscaticus*	BLM S, SR, G1	Narrow range; floodplain terraces in shady canyons	Graham, Maricopa
Flagstaff false pennyroyal	*Hedeoma diffusa*	SR, G3	Rock pavement, cliff, limestone and sandstone break habitats in ponderosa pine between 4,500-7,140 feet elevation	Coconino, Yavapai
Flannel bush	*Fremontodendron californicum*	SR, G4	On dry slopes in canyons between 3,500-6,500 feet elevation	Gila, Maricopa, Mohave, Pinal, Yavapai
Gentry indigo bush	*Dalea tentaculoides*	BLM S, HS, G1	Narrow range; floodplain terraces in shady canyons	Pima, Santa Cruz
Giant sedge	*Carex spissa* var. *ultra*	BLM S, G3	Springs	Cochise, Graham
Gierisch mallow	*Sphaeralcea gierischii*	C, G1	Found only on gypsum outcrops associated with Harrisburg member of Kaibab Formation	Mohave
Gila groundsel	*Senecio quaerens*	SR, G3	Riparian areas in spruce-fir and ponderosa pine forests between 7,500 – 9,200 feet elevation	Apache, Greenlee
Gladiator milkvetch	*Astragalus xiphoides*	SR, G3	High sandstone mesas and clay bluffs at 4,900-6,000 feet elevation	Apache, Coconino, Navajo
Goodding onion	*Allium gooddingii*	HS, G4	Moist, shaded canyon bottoms in conifer forest and mountain meadows around 8,000 feet elevation	Apache, Greenlee, Pima
Grand Canyon beavertail cactus	*Opuntia basilaris* var. *longiareolata*	SR, G5T2	Rocky soils at bases of talus slopes in the desert at 1,950 feet elevation	Coconino, Mohave
Grand Canyon cottontop cactus	*Echinocactus polycephalus* var. *xeranthemoides*	SR, G3G4T1T3	Rocky hills, slopes, and ledges of canyons in Great Basin and Mohave Desert scrub between 1,803-6,479 feet elevation	Coconino, Mohave
Grand Canyon century plant	*Agave phillipsiana*	HS, G1	Sandy to gravelly places with desert scrub between 2,300-3,600 feet elevation	Coconino

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Grand Canyon flaveria	*Flaveria mcdougallii*	SR, G2	Hanging gardens or terrace ledges in perennial alkaline or saline seeps between 1,750-4,000 feet elevation	Coconino, Mohave
Grand Canyon primrose	*Primula specuicola*	SR, G4	Moist sites from hanging gardens or alcoves from 1,250-7,600 feet elevation	Coconino
Grand Canyon rose	*Rosa stellata* var. *abyssa*	BLM S, SR, G4T2	Narrow range; limestone cliff rims	Coconino, Mohave
Green death camas	*Zigadenus virescens*	SR, G4	Montane coniferous forest between 3,300-10,500 feet elevation	Apache, Cochise, Coconino, Greenlee
Hedgehog cactus	*Echinocereus pseudopectinatus*	SR, G4	Semidesert grasslands between 4,000-4,600 feet elevation	Cochise
Holmgren (Paradox) milk vetch	*Astragalus holmgreniorum*	E, HS, G1	Just under limestone ridges and along draws in gravelly clay hills	Mohave
Hohokam agave	*Agave murpheyi*	HS, G2	Sonoran Desert scrub between 1,300-3,200 feet elevation	Gila, Maricopa, Pinal, Yavapai
House Rock fishhook cactus	*Sclerocactus sileri*	SR, G1	Found in the House Rock Valley and Paria Plateau in pinyon-juniper mesa tops between 4,200-7,000 feet elevation	Coconino
Huachuca golden aster	*Heterotheca rutteri*	BLM S, G2	Narrow range; Plains Grassland, LCNCA	Cochise, Pima, Santa Cruz
Huachuca groundsel	*Senecio multidentatus* var. *huachucanus*	HS, G2G4	Steep, rocky high elevation mountain slopes and in canyon bottoms within pine-oak or mixed-conifer dominated forests between 7,000 - 9,500 feet elevation	Cochise, Santa Cruz
Huachuca milkvetch	*Astragalus hypoxylus*	BLM S, SR, G1	Narrow range; open, rocky clearings in woodland at approximately 5,500 feet elevation	Cochise, Santa Cruz
Huachuca water umbel	*Lilaeopsis schaffneriana* ssp. *recurva*	E, HS, G4	Marshy wetlands between 2,000-7,100 feet elevation	Cochise, Pima, Pinal, Santa Cruz
Intermediate fishhook cactus	*Sclerocactus parviflorus* ssp. *intermedius*	SR, G4T3?	In desert grasslands or saltbush, sagebrush, rabbitbrush, and blackbrush communities, pinyon-juniper woodlands between 3,300-6,900 feet elevation	Coconino, Mohave
Jones' cycladenia	*Cycladenia humilis* var. *jonesii*	T, HS, G3G4T2	Mixed desert scrub, juniper, or wild buckwheat-mormon tea	Mohave
Kaibab pincushion (plains) cactus	*Pediocactus paradinei*	BLM S, HS, G2	Narrow range; open pinyon-juniper woodlands and sagebrush valleys	Coconino
Kearney sumac	*Rhus kearneyi* ssp. *kearneyi*	BLM S, SR, G4	Relict species in shady canyons	Yuma

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Kearney's blue star	*Amsonia kearneyana*	E, WSC, G1	West-facing drainages in the Baboquivari Mountains	Pima
Kelvin cholla	*Cylindropuntia x kelvinensis*	SR, GNA	Sonoran Desert scrub, edges of grasslands, rocky flats and slopes, and rolling hills between 1,650-3,300 feet elevation	Pima
Kingman's prickly-pear	*Opuntia superbospina*	SR, GHQ	Relatively flat areas of the Mojave desert floor between 2,500-4,400 feet elevation	Mohave
Kofa Mountain barberry	*Berberis harrisoniana*	BLM S, G1G2	Relict species in shady canyons	Maricopa, Pima, Yuma
Las Vegas bearpoppy	*Arctomecon californica*	SR, G3	Mohave desert scrub between 1,200-4,000 feet elevation	Mohave
Leafy lobelia	*Lobelia fenestralis*	SR, G4	Moist meadows, swales, and grasslands between 3,500-6,000 feet elevation	Cochise, Santa Cruz
Lemmon fleabane	*Erigeron lemmonii*	C, G1	Grows in dense clumps in crevices, ledges, and boulders in canyon bottoms in pine-oak woodland	Cochise
Lemmon lily	*Lilium parryi*	SR, G3	Montane conifer forest between 5,500-7,800 feet elevation	Cochise, Pima, Santa Cruz
Lesser rattlesnake plantain	*Goodyera repens*	SR, G5	Coniferous forest	Apache, Greenlee
Limestone Arizona rosewood	*Vauquelinia californica ssp. pauciflora*	SR, G4T3	Dry limestone ridges and hills and rhyolite	Cochise
Littleleaf false tamarind	*Lysiloma watsonii*	SR, G4?	Rocky hillsides and slopes of creeks and tributaries in the Rincon Mountains	Pima
Madrean adders mouth	*Malaxis corymbosa*	SR, G4	Shaded mountain canyons around 6,500 feet elevation	Cochise, Santa Cruz
Madrean ladies tresses	*Spiranthes delitescens*	HS, G1	Marshy wetland or cienega intermixed with tall grasses and sedges between 4,585-4,970 feet elevation	Cochise, Santa Cruz
Magenta-flower Hedgehog-cactus	*Echinocereus fasciculatus*	SR, G4G5T4T5	Canyons in desert scrub, semidesert grasslands, and chaparral between 1,800-5,600 feet elevation	Greenlee, Pima
Maguire's penstemon	*Penstemon linarioides* ssp. *maguirei*	SR, G5T1	Found in the Gila River Valley in conifer woodlands between 6,000-6,500 feet elevation	Greenlee
Marble Canyon indigo bush	*Psorothamnus arborescens* var. *pubescens*	BLM S, G5T2	Narrow range; red soils of Moenkopi Formation Marble Canyon	Coconino, Mohave
Marble Canyon milkvetch	*Astragalus cremnophylax* var. *hevronii*	BLM S, G1T1	Narrow range; limestone cliff rims in Marble Canyon	Coconino
Mazatzal triteleia	*Triteleia lemmoniae*	SR, G3	Pine woodlands between 3,200-7,700 feet elevation	Coconino, Gila, Yavapai

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Mckelvey's agave	*Agave mckelveyana*	SR, G4	Desert scrub, chaparral, and pinyon-juniper woodlands between 2,600-7,200 feet elevation	Yavapai
Mexican lobelia	*Lobelia laxiflora*	SR, G4	Woodland habitats	Santa Cruz
Michoacan ladies tresses	*Stenorrhynchos michuacanum*	SR, G4	Open grassy slopes, sand pine-oak woodlands between 6,200-7,200 feet elevation	Cochise, Santa Cruz
Missouri corycactus	*Coryphantha missouriensis*	SR, G5T4	Desert edge, grasslands, lower mountains	Coconino, Mohave
Mogollon columbine	*Aquilegia desertorum*	SR, G4	Grows on ledges and bluffs in ponderosa pine	Coconino
Mogollon thistle	*Cirsium parryi* ssp. *mogollonicum*	SR, G4T1	The shaded riparian understory of perennial streams around 7,200 feet elevation	Coconino,
Morton wild-buckwheat	*Eriogonum mortonianum*	SR, G1	Great Basin desert scrub, usually along small drainages around 4,650 feet elevation	Mohave
Mount Tumbull beardtongue	*Penstemon distans*	BLM S, SR, G2	Narrow range; moist, cool microhabitats on canyon slopes	Mohave
Murphey agave	*Agave murpheyi*	BLM S, G2	Low numbers; in the desert foothills of central Arizona	Gila, Maricopa, Pinal, Yavapai
Navajo bridge cactus	*Opuntia nicholii*	SR, G4Q	Gravelly soils of flats and low ridges in the desert	Coconino, Mohave
Navajo sedge	*Carex specuicola*	T, HS, G2	Found within pinyon-juniper woodland between 4,600-7,200 feet elevation	Apache, Coconino, Navajo
Needle-spined pineapple cactus	*Echinomastus erectocentrus* var. *erectocentrus*	SR, G4T2	Desert grasslands between 2,900-4,900 feet elevation	Cochise, Pima, Pinal
Nichol Turk's head cactus	*Echinocactus Horizonthalonius* var. *nicholii*	E, HS, G4T2	Sonoran Desert scrub	Pima, Pinal
Night-blooming cereus	*Peniocereus greggii* var. *greggii*	SR, G3G4T2	Gravelly flats and washes in desert shrublands or shrub-invaded grasslands	Cochise
Nutrioso milkvetch	*Astragalus nutriosensis*	SR, G3?	Mesa tops at approximately 7,500 feet elevation in open grassland or pinyon-juniper	Apache
Organ pipe cactus	*Stenocereus thurberi*	SR, G5	Sonoran Desert scrub between 1,400-3,000 feet elevation	Maricopa, Pima, Pinal
Our lords candle	*Yucca whipplei*	SR, G4G5	Dry, stony slopes, chaparral and mountains between 1,000-4,000 feet elevation	Coconino, Mohave
Paper-spined cactus	*Pediocactus papyracanthus*	SR, G4	Open flats in grasslands and pinyon-juniper woodlands between 5,000-7,300 feet elevation	Apache, Navajo
Paria plateau fishhook cactus	*Sclerocactus sileri*	BLM S, G1	Narrow range; sandy soils on the Paria Plateau	Coconino
Parish alkali grass	*Puccinellia parishii*	HS, G2G3	Wet habitats	Apache, Coconino, Yavapai

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Parish phacelia	*Phacelia parishii*	BLM S, G2G3	Narrow range; limestone deposits in the Burro Creek area, dry lake beds in Red Lake	Mohave
Parish wild onion	*Allium parishii*	BLM S, SR, G3	Narrow range; higher elevation desert mountains, such as the Mohave Mountains	Yuma
Peebles Navajo cactus	*Pediocactus peeblesianus var. peeblesianus*	E, HS, G1G2T1	Gravely soils of the Shinarump conglomerate of the Chinle Formation	Navajo
Pima Indian mallow	*Abutilon parishii*	BLM S, SR, G2	Rocky slopes, good condition desert mountains	Gila, Graham, Maricopa, Pima, Pinal, Santa Cruz, Yavapai
Pima pineapple cactus	*Coryphantha scheeri* var. *robustispina*	E, HS, G4T2	Sonoran Desert scrub or semi-desert grassland communities	Pima, Santa Cruz
Pinaleno hedgehog cactus	*Echinocereus ledingii*	SR, G4G5	Rocky outcrops between 4,000 – 7,400 feet elevation	Cochise, Graham
Pinos Altos flame flower	*Talinum humile*	SR, G2	Rocky slopes at about 7,000 feet elevation, interior chaparral and Great Basin conifer woodland	Santa Cruz
Pinto beardtongue	*Penstemon bicolor*	BLM S, G3?	Narrow range; desert washes in the Black Mountains	Mohave
Playa spider plant	*Cleome multicaulis*	SR, G2G3	Moist, alkaline grasslands	Cochise
Plummer onion	*Allium plummerae*	SR, G4	Wet meadows, stream banks, and rocky slopes between 4,800-9,000 feet elevation	Cochise, Pima
Purple adder's mouth	*Malaxis porphyrea*	SR, G4	Mixed conifer forest between 7,000 – 9,200 feet elevation	Apache, Cochise, Coconino, Greenlee, Santa Cruz
Purple-spike coralroot	*Hexalectris warnockii*	BLM S, G2G3	Few populations; leaf litter under Madrean woodland	Cochise
Redflower onion	*Allium rhizomatum*	SR, G4	Grassy areas in juniper-oak woodland between 4,000-7,000 feet elevation	Cochise, Santa Cruz
Ripley wild buckwheat	*Eriogonum ripleyi*	SR, G2	On well-drained powdery soils derived from limestone, sandstone, or volcanic tuffs and ashes between 2,000-6,000 feet elevation	Coconino, Maricopa, Yavapai
Rocky Mountain bristlecone pine	*Pinus aristata*	SR, G3	Cold, dry subalpine habitats between 8,200-12,000 feet elevation	Coconino
Round-leaf broom	*Errazurizia rotundata*	BLM S, SR, G2	Narrow range; Shinarump Hills, Holbrook area	Coconino, Navajo
Roundleaf errazurizia	*Errazurizia rotundata*	SR, G2	Rocky hilltops and ledges between4,620-5,200 feet elevation	Coconino, Navajo
Saiya	*Amoreuxia gonzalezii*	HS, G1	Rocky limestone hillsides between 4,200-4,600 feet elevation	Pima, Santa Cruz
San Carlos wild-buckwheat	*Eriogonum capillare*	SR, G4	Wash bottoms, road cuts, and berms between 1,980-4,650 feet elevation	Cochise, Gila, Graham, Greenlee, Pima, Pinal

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Sand food	*Pholisma sonorae*	BLM S, G2	Sand dunes near Yuma	Yuma
San Francisco Peaks groundsel	*Packera franciscana*	T, HS, G1	Found on talus slopes on the San Francisco Peaks, between 11,000-12,300 feet elevation	Coconino
San Pedro River wild buckwheat	*Eriogonum terrenatum*	BLM S, G1	Narrow range; limestone and clay soils of the St. David Formation in the SPRNCA	Cochise, Pima
Santa Cruz beehive cactus	*Coryphantha recurvata*	HS, G3	Valleys, mesas, and foothills in grassland and oak belts at 4,000-5,900 feet	Santa Cruz
Santa Cruz striped agave	*Agave parviflora* ssp. *parviflora*	HS, G3T2	Slopes and ridges in desert grassland and oak woodland between 3,600-4,600 feet elevation	Pima, Santa Cruz
Scaly sand food	*Pholisma arenaria*	BLM S, HS, G3	Sand dunes on the Cactus Plain	La Paz
Schott wire-lettuce	*Stephanomeria schottii*	BLM S, G2	Sand dunes and sandy soils in the Yuma area	Yuma
Senita	*Lophocereus schottii*	SR, G4	Heavy or sandy soils of valleys and plains in the desert	Pima, Yuma
Sentry milk vetch	*Astragalus cremnophylax* var. *cremnophylax*	E, HS, G1T1	In the pinyon-juniper-cliffrose plant community above 4,000 feet elevation	Coconino
September 11 stickleaf	*Mentzelia memorabalis*	BLM S, G1	Narrow range; gypsum soils of Harrisburg Formation	Mohave
Siler pincushion cactus	*Pediocactus sileri*	T, HS, G3	Desert scrub transitional areas of Navajo, sagebrush and Mohave Deserts	Coconino, Mohave
Silverleaf sunray	*Enceliopsis argophylla*	BLM S, G2G3	Narrow range; gypsum soils of Moenkopi Formation	Mohave
Simpson plains cactus	*Pediocactus simpsonii*	SR, G4	On rocky soils of high valleys, mountainsides, and grasslands	Coconino
Slender adders mouth	*Malaxis tenuis*	SR, G4	Meadows and shady, rocky hills up to 10,000 feet elevation	Cochise, Pima
Slender bog orchid	*Platanthera purpurascens*	SR, G5	Wet habitats between 8,200-10,800 feet elevation	Apache, Graham, Greenlee
Slender evening-primrose	*Camissonia exilis*	SR, G1	Warm desert shrub communities, apparently in association with subsurface seepage between 3,500-5,000 feet elevation	Coconino, Mohave
Slender needle corycactus	*Coryphantha scheeri* var. *valida*	SR, G4T4	Grasslands and deserts around 4,000 feet elevation	Cochise
Smallflower fishhook cactus	*Sclerocactus parviflorus* ssp. *parviflorus*	SR, G4	Gravelly or sandy soils in desert or woodland	Coconino
Smooth catseye	*Cryptantha semiglabra*	BLM S, G1?	Narrow range; mixed desert shrub, sagebrush, and pinyon-juniper communities	Coconino, Mohave
Staghorn cholla	*Opuntia versicolor*	SR, G4	Deeper soils of canyons, washes, and well watered areas in the desert	Pima, Pinal, Santa Cruz

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Sticky wild buckwheat	*Eriogonum viscidulum*	BLM S, G2	Narrow range; sandy loam soils in the Virgin River Valley	Mohave
Straw-top cholla	*Opuntia echinocarpa*	SR, G3G4Q	On benches, slopes, mesas, flats and washes in desert habitats between 1,000-6,700 feet elevation	La Paz, Maricopa, Mohave, Yuma
Sunset Crater beardtongue	*Penstemon clutei*	SR, G2	Cinder fields that are devoid of a soil covering and where other herbaceous vegetation is sparse between 6,100 - 8,500 feet elevation	Coconino
Supine bean	*Macroptilium supinum*	SR, G2	Semi desert grassland or grassy openings in oak-juniper woodland between 3,600-4,900 feet elevation	Santa Cruz
Tepic flame flower	*Talinum marginatum*	SR, G2	Mountainous areas with pine-oak woodland and areas of low rolling hills between 5,000-7,000 feet elevation	Cochise, Santa Cruz
Texas purple spike	*Hexalectris warnockii*	HS, G2G3	Along streambeds in oak-mixed conifer habitats between 5,000-7,000 feet elevation	Cochise
Thornber fishhook cactus	*Mammillaria thornberi*	SR, G4	Deep, gravelly soils on floodplains, alluvial fans, and deeply dissected uplands between 780-2,400 feet elevation	Pima, Pinal
Three-cornered milkvetch	*Astragalus geyeri* var. *triquetrus*	BLM S, G4T2T3	Narrow range; sandy loam soils in the Virgin River Valley	Mohave
Thurber's bog orchid	*Platanthera limosa*	SR, G4	Open to lightly forested springy marshes, seeps, stream banks between 5,900-8,200 feet elevation	Cochise, Pima
Thurber Indian mallow	*Abutilon thurberi*	SR, G2?	Near the mouths of canyons in the Baboquivari Mountains around 3,450 feet elevation	Pima
Trelease agave	*Agave schottii* var. *treleasei*	HS, G5T1Q	Desert scrub, grasslands, juniper, and oak woodlands in the Santa Catalina Mountains between 3,600-6,560 feet elevation	Pima, Pinal, Cochise
Tonto Basin agave	*Agave delamateri*	HS, G2	Upper Sonoran Desert scrub between 2,200-5,100 feet elevation	Gila, Maricopa, Yavapai
Toumey agave	*Agave toumeyana* var. *bella*	SR, G3T3	Rocky slopes in chaparral between 4,000-5,000 feet elevation	Gila, Maricopa, Pinal, Yavapai
Tumamoc globeberry	*Tumamoca macdougalii*	BLM S, SR, G4	Few populations; Sonoran Desert plains	Maricopa, Pima, Pinal

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Tusayan flame flower	*Talinum validulum*	SR, G3	Open mountain meadows and shallow basins at the rims of canyons and flat ridgetops between 5,600-7,700 feet elevation	Coconino, Yavapai
Utah solitaire lily	*Eremocrinum albomarginatum*	SR, G3	Deep sandy areas in salt desert shrub; sand dunes	Apache
Varied fishhook cactus	*Mammillaria viridiflora*	SR, G4	Oak woodland and forest edges between 4,900-6,900 feet elevation	Cochise, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Yavapai
Verde Valley sage	*Salvia dorrii* ssp. *mearnsii*	SR, G5T3	Gypseous limestone at elevations of 3,100-5,100 feet	Yavapai
Viviparous foxtail cactus	*Escobaria vivipara* var. *rosea*	SR, G5T3	Near Peach Springs on rocky and gravelly slopes in woodland or desert mountains between 4,900-9,000 feet elevation	Mohave, Yavapai
Welsh's milkweed	*Asclepias welshii*	T, HS, G1	Open, sparsely vegetated sand dunes in sagebrush, juniper, pine and oak communities of the Great Basin desert scrub between 5,550-6,250 feet elevation	Coconino, Navajo
Western fairy slipper	*Calypso bulbosa*	SR, G5	Dry coniferous slopes	Apache, Coconino, Greenlee
Whipple cholla	*Opuntia whipplei* var. *whipplei*	SR G4?	Flats, valleys, plains, and gentle slopes in grasslands	Mohave
Whisk fern	*Psilotum nudum*	HS, G5	In rock crevices, on trees, and on the ground up to 4,000 feet elevation	Pima, Santa Cruz
White Mandarin twisted stalk	*Streptopus amplexifolius*	SR, G5	Coniferous and deciduous forests up to 9,200 feet elevation	Apache
White-margined penstemon	*Penstemon albomarginatus*	BLM S, SR, G2	Narrow range; sandy loam soils at Dutch Flat	Mohave
White Mountains paintbrush	*Castilleja mogollonica*	SR, G5?	Grassy meadows associated with creeks between 8,500 – 9,500 feet elevation	Apache
Wilcox fishhook cactus	*Mammillaria wrightii* var. *wilcoxii*	SR, G4T4	Grassland or along the edges of woodlands	Cochise, Graham, Santa Cruz
Wislizeni gentian	*Gentianella wislizeni*	SR, G2	Open meadows or shaded slopes between 6,500-8,000 feet elevation	Cochise, Greenlee
Woodland spurge	*Euphorbia macropus*	SR, G4	Pine-oak woodland between 2,100-7,400 feet elevation	Cochise, Santa Cruz
Wright fishhook cactus	*Mammillaria wrightii* var. *wrightii*	SR, G4T3	Grassland and woodland habitats between 4,900-7,900 feet elevation	Apache
Yellow beavertail	*Opuntia basilaris* var. *aurea*	SR, G5	Pinyon-juniper woodlands between 4,900-5,900 feet elevation	Coconino, Mohave
Yellow lady's-slipper	*Cypripedium parviflorum* var. *Pubescens*	HS, G5T5	Damp woods, near rivers, and in wet meadows	Apache, Greenlee

Table 3-32 *(continued)*
Special Status Plant Species with Potential to Occur in the Planning Area

Common name	Scientific name	Status[1]	Habitat	Counties of Known/Potential Occurrence
Zuni fleabane	*Erigeron rhizomatus*	T, HS, G2	Selenium-rich red or gray detrital clay soils derived from the Chinle and Baca formations	Apache

[1]Status
T- Federally Threatened
E- Federally Endangered
C- Candidate for federal listing
BLM S- BLM AZ sensitive species
WSC – Wildlife of Special Concern in Arizona
HS- AZ Highly Safeguarded plant: no collection allowed.
SR- AZ Salvage Restricted plant: collection only with permit.
Sources: NatureServe 2011; AZGFD 2011b; Source of the taxonomy is the AZGFD Heritage Data Management System.

Other Special Status Species

Special status species related to the planning area include those species that are listed as Arizona BLM Sensitive Species; AZDFG Wildlife Species of Special Concern; or are protected under the Arizona Native Plant List (ANPL) as Highly Safeguarded or Salvage-Restricted Native Plants by the Arizona Department of Agriculture (AZDA). Descriptions are included below.

Criteria for BLM Sensitive Species (BLM Manual Section 6840) include those that are:

1. Under status review by the USFWS/National Marine Fisheries Service; or
2. Whose numbers are declining so rapidly that federal listing may become necessary; or
3. With typically small and widely dispersed populations; or
4. Those inhabiting ecological refugia or other specialized or unique habitats (BLM 2008e).

BLM policy, as specified in BLM Manual 6840, is "to provide policy and guidance for the conservation of BLM special status species and the ecosystems upon which they depend on BLM-administered lands." Objectives of the BLM special status species policy are to 1) conserve and/or recover ESA-listed species and the ecosystems on which they depend so that ESA protections are no longer needed for these species; and 2) initiate proactive conservation measures that reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing of these species under the ESA.

The BLM Arizona State Director maintains a list of sensitive species, and impacts on these species would have to be considered in project-specific

assessments developed before approval of any activity that would affect listed or proposed species or critical habitat. An updated list of sensitive species was published in December 2010.

AZGFD Wildlife of Special Concern are those species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the AZGFD's listing of Wildlife of Special Concern in Arizona (AZGFD in prep).

AZDA Highly Safeguarded or Salvage Restricted Native Plants are special status plants protected under the ANPL and fall into the following categories: Highly Safeguarded (no collection allowed); Salvage Restricted (collection allowed only with permit); Export Restricted (transport out of State prohibited); Salvage Assessed (permits required to remove live trees); and Harvest Restricted (permits required to remove plant byproducts).

Special status species with the potential to occur in the planning area are included in **Table 3-31**, Special Status Animal Species with the Potential to Occur in the Planning Area, and **Table 3-32**, Special Status Plant Species with the Potential to Occur in the Planning Area, below.

The USFWS has published a list of proposed, candidate, threatened, and endangered species occurring by county in Arizona (USFWS 2011). In addition, the AZGFD has published a list of special status species occurring by county in Arizona (AZGFD 2011b). These lists were consulted to provide a basis for special status species that might be present in the planning area and are included in the table below. Habitat information for each species and counties of occurrence are included below. Site-specific assessment, including literature and field review to determine the likelihood of occurrence of specific special status species and their habitats, would be conducted prior to site permitting and development.

3.19.2 Agua Caliente Solar Energy Zone Affected Environment

The AZGFD has identified 36 species of greatest conservation need (SGCN) that have the potential to occur within the Agua Caliente SEZ based on habitat availability and species range. These species are identified in the Comprehensive Wildlife Conservation Strategy and are all listed as Tier 1a and 1b, which are the species in most immediate need of conservation (AZGFD 2006). In addition, 17 BLM sensitive species could occur on lands within the BLM Yuma Field Office. All identified sensitive species are identified in **Table 3-33**, Special Status Species with Potential to Occur in the Proposed Agua Caliente SEZ, below.

Table 3-33
Special Status Species with Potential to Occur in the Proposed Agua Caliente SEZ

Common name	Scientific Name	Status[1]	Potential for occurrence[2]
Birds			
Abert's towhee	*Melozone aberti*	SGCN	P
American bittern	*Botaurus lentiginosus*	BLM S, WSC, SGCN	U
Arizona Bell's vireo	*Vireo bellii arizonae*	SGCN	U
Bald eagle – wintering population	*Haliaeetus leucocephalus*	BLM S, WSC, SGCN	U
Cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*	BLM S, WSC	P
California black rail	*Laterallus jamaicensis coturniculus*	BLM S	U
Ferruginous hawk	*Buteo regalis*	BLM S, WSC, SGCN	P
Gila woodpecker	*Melanerpes uropygialis*	SGCN	P
Gilded flicker	*Colaptes chrysoides*	SGCN	P
Golden eagle	*Aquila chrysaetos*	BLM S, SGCN	P
Le Conte's thrasher	*Toxostoma lecontei*	BLM S, SGCN	P
Lincoln's sparrow	*Melospiza lincolnii*	SGCN	U
Mountain plover	*Charadrius montanus*	SGCN	P
Pacific wren	*Troglodytes pacificus*	SGCN	U
Savannah sparrow	*Passerculus sandwichensis*	SGCN	U
Sprague's pipit	*Anthus spragueii*	C, WSC, SGCN	U
Western burrowing owl	*Athene cunicularia hypugaea*	BLM S, SGCN	P
Wood duck	*Aix sponsa*	SGCN	U
Mammals			
American beaver	*Castor canadensis*	SGCN	U
Arizona pocket mouse	*Perognathus amplus*	SGCN	P
California leaf-nosed bat	*Macrotus californicus*	BLM S, WSC, SGCN	P
Cave myotis	*Myots velifer*	SGCN	P
Desert bighorn sheep	*Ovis canadensis mexicana*	SGCN	U
Greater western mastiff bat	*Eumops perotis californicus*	BLM S, SGCN	P
Harquahala southern pocket gopher	*Thomomys bottae subsimilis*	SGCN	P
Harris' antelope squirrel	*Ammospermophilus harrisii*	SGCN	P
Kit fox	*Vulpes macrotis*	SGCN	P
Little pocket mouse	*Perognathus longimembris*	SGCN	P
Mexican free-tailed bat	*Tadrida brasiliensis*	SGCN	P
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	BLM S, SGCN	P
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	SGCN	P
Sonoran pronghorn	*Antilocapra americana sonoriensis*	E, WSC	P
Western yellow bat	*Lasiurus xanthinus*	WSC, SGCN	P
Yuma myotis	*Myotis yumanensis*	SGCN	P
Amphibians/Reptiles			
Flat-tailed horned lizard	*Phrynosoma mcallii*	P, WSC	P
Gila monster	*Heloderma suspectum*	SGCN	U
Lowland leopard frog	*Lithobates yavapaiensis*	BLM S, WSC, SGCN	U
Sonoran Desert toad	*Bufo alvarius*	SGCN	U
Sonoran Desert tortoise	*Gopherus agassizii (Sonoran population)*	WSC, SGCN	U
Yuman desert fringe-toed lizard	*Uma rufopunctata*	BLM S, WSC	U
Plants			
Blue sand lily	*Triteleiopsis palmeri*	BLM S	P
Kearney sumac	*Rhus kearneyi*	BLM S	U
Kofa Mountain barberry	*Berberis harrisoniana*	BLM S	U
Parish onion	*Allium parishii*	BLM S	U
Sand food	*Pholisma sonorae*	BLM S	U
Schott wire lettuce	*Stephanomeria schottii*	BLM S	P

Table 3-33 *(continued)*
Special Status Species with Potential to Occur in the Proposed Agua Caliente SEZ

Common name	Scientific Name	Status[1]	Potential for occurrence[2]

[1]Status
E- Federally Endangered
P – Proposed Threatened
C- Candidate for federal listing
BLM S – BLM Sensitive
WSC – Wildlife of Special Concern in Arizona
SGCN – Species of Greatest Conservation Need
[2] Potential for Occurrence
P – Potential to occur
U – Unlikely to occur
Sources: NatureServe 2011; AZGFD 2012

A field survey was conducted in August 2011 by a qualified field biologist to identify any potential habitat for special status species on or near the site. The potential for occurrence is based on the site visit and the habitat information presented in **Table 3-31**, Special Status Animal Species with Potential to Occur in the Planning Area and **Table 3-32**, Special Status Plant Species with Potential to Occur in the Planning Area, above. The results of the AZGFD, SGCN, and BLM sensitive lists and field survey are included in **Table 3-33**, Special Status Species with Potential to Occur in the Proposed Agua Caliente SEZ, above.

The proposed SEZ may provide potential habitat for several special status species, although no known species-specific special status species surveys have been conducted on-site. There is potential habitat for burrowing owls in certain locations that have suitable soils and erosional features, such as caliche caves. There is no golden eagle nesting habitat on site, though the area could provide foraging habitat, and golden eagle prey (e.g., lagomorphs) were observed on site.

Several special status bird and bat species could utilize the habitats within the proposed SEZ, including both the riparian areas and the desert scrub. There is Category 3 desert tortoise habitat to the west and north of the proposed SEZ, although since the site is relatively flat and does not have rocky, steep habitat, it is unlikely to provide potential habitat. The northern portion of the proposed SEZ may serve as a movement corridor for desert tortoise. As described in **Section 3.6**, Fish and Wildlife, the area within and around the SEZ has been identified as a potential reintroduction area for Sonoran pronghorn.

Special status species populations in the proposed SEZ are likely stable given the relatively rural and undisturbed nature of the site. The current adjacent solar development could be displacing or disturbing wildlife in and around that area, causing more wildlife to inhabit the proposed SEZ site for refuge.

3.20 TRAVEL MANAGEMENT

3.20.1 RDEP Affected Environment

Arizona is served by an extensive network of state and interstate highway systems. The National Highway System provides access to major metropolitan centers of Phoenix and Tucson, and smaller cities like Flagstaff and Yuma. Other national and state highways connect multiple municipalities and provide access to destinations like Grand Canyon National Park.

Over the past 10 years, federal land management agencies have instituted policies to provide networks of roads and trails for motorized access. 43 CFR 8230 requires the BLM to designate all BLM-administered lands as open, limited, or closed to OHV travel. This policy has resulted in the implementation of a system of designated roads and trails, whereby cross-country travel is only allowed in specified areas, and motorized vehicles must stay on those routes designated for motorized travel.

In response to 36 CFR 212, Subpart B, the Forest Service has instituted a similar policy for motorized travel, requiring each national forest to produce a Motor Vehicle Use Map that depicts the routes on which motorized vehicles are allowed to travel. In Arizona, the Prescott National Forest has published its Motor Vehicle Use Map (Forest Service 2009). The Apache-Sitgreaves, Coconino, Coronado, Kaibab, and Tonto National Forests are currently preparing their Motor Vehicle Use Map (Forest Service 2010d).

OHV use is prohibited in many NPS units, though driving for pleasure on paved roads is a popular activity.

On BLM, Forest Service, and NPS-administered lands, cross-country nonmotorized travel remains largely permissible outside of some special designation areas. Mountain bicycle use is allowed on some designated routes within the National Parks System, such as the Cactus Forest Trail in Saguaro National Park.

Demand for public access is expected to continue to grow as the Southwest's population grows and motorized vehicles make previously remote areas more accessible. Travel management has become a prominent planning issue for land management agencies and will continue to be a high-profile issue.

3.20.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is located within the Dispersed Recreation RMZ of the 526,900-acre Yuma East Undeveloped SRMA. Motorized travel within the entire RMZ is managed as "limited to designated routes," meaning vehicles can only travel on existing inventoried routes appearing on the Yuma Field Office route inventory maps that were published with the Yuma Field Office RMP (BLM 2010g). Nonmotorized uses are allowed to travel cross-

country, though limitations can be put in place for competitive and permitted events.

Numerous routes traverse the proposed SEZ, most heading north-south and crossing or originating/terminating on private and state land. These routes receive heavy use during hunting season and are inventoried as "digital linear features" (i.e., linear features appearing on aerial photos that need to be field-checked and may not exist) or "nonmotorized routes" by the Yuma Field Office RMP (BLM 2010g).

3.21 VEGETATION

This section addresses the vegetation communities within the planning area. A vegetation community is an assemblage of individual plant species that grow together in the same general geographic location. Special status plant species are addressed in **Section 3.19**, Special Status Species.

The Federal Noxious Weed Act of 1974 provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. The act prohibits importing or moving any noxious weeds identified by the regulation and allows for inspection and quarantine to prevent the spread of noxious weeds.

Signed in 1999, Executive Order 13112, Invasive Species directs federal agencies to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause. To accomplish this, the Executive Order established the National Invasive Species Council; currently there are 13 departments and agencies represented on the council.

3.21.1 RDEP Affected Environment

This discussion includes ecoregions in Arizona per the Draft Arizona Comprehensive Wildlife Conservation Strategy (AZGFD 2006) and vegetation communities per the Southwest Regional GAP Analysis Project (SWreGAP) (USGS National Gap Analysis Program 2004). GIS was used where possible to quantify acreages of vegetation communities. Comprehensive biological surveys were not conducted within the entire planning area.

Ecoregions

Ecoregions are defined as "areas–on the scale of tens of millions of acres–that are characterized by phenomena that influence the character of specific habitat types. These large-scale phenomena include environmental conditions such as climate and landforms, as well as regional human activities and population centers" (AZGFD 2006). Arizona is composed of the following ecoregions: Colorado Plateau, Arizona/New Mexico Plateau, Arizona/New Mexico Mountains, Madrean Archipelago, Mojave Basin and Range, Chihuahuan Desert,

and Sonoran Basin and Range (see **Table 3-34**, Level III Ecoregions in Arizona, and **Figure 3-21**, Level III Ecoregions) (EPA 2011b).

Table 3-34
Level III Ecoregions in Arizona

Ecoregion	Acres in Arizona
Colorado Plateau	1,188,100
Arizona/New Mexico Plateau	8,852,500
Arizona/New Mexico Mountains	12,283,300
Madrean Archipelago	8,644,100
Mojave Basin and Range	3,604,300
Chihuahuan Desert	158,700
Sonoran Basin and Range	18,113,000

Source: EPA 2011b

Colorado Plateau

The Colorado Plateau ecoregion is an uplifted, eroded, and deeply dissected tableland. Its benches, mesas, buttes, salt valleys, cliffs, and canyons are formed in and underlain by thick layers of sedimentary rock. Precipitous side-walls mark abrupt changes in local relief, often from 1,000 to 2,000 feet. The region contains a greater extent of pinyon-juniper and Gambel oak woodlands than the Wyoming Basin to the north. There are also large low-lying areas containing saltbrush-greasewood (typical of hotter drier areas), which are generally not found in the higher Arizona/New Mexico Plateau to the south where grasslands are common. Summer moisture from thunderstorms support warm season grasses not found in the Central Basin and Range to the west. Many endemic plants occur, and species diversity is greater than in the Central Basin and Range (EPA 2010b).

Arizona-New Mexico Plateau

The Arizona/New Mexico Plateau represents a large transitional region between the semiarid grasslands and low relief tablelands of the Southwestern Tablelands in the east, the drier shrublands and woodland-covered higher relief tablelands of the Colorado Plateau in the north, and the lower, hotter, less-vegetated Mojave Basin and Range in the west and Chihuahuan Desert in the southeast. Higher forest-covered mountainous ecoregions border the region on the northeast (Southern Rockies ecoregion) and south (Arizona/New Mexico Mountains ecoregion). Local relief in the region varies from a few feet on plains and mesa tops to well over 1,000 feet along tableland side slopes (EPA 2010b).

Arizona/New Mexico Mountains

The Arizona/New Mexico Mountains are distinguished from neighboring mountainous ecoregions by their lower elevations and associated vegetation indicative of drier, warmer environments, which is due in part to the region's more southerly location. Forests of spruce, fir, and Douglas-fir, which are common in the Southern Rockies and the Uinta and Wasatch Mountains, are

Level III Ecoregions

Ecoregions are large scale areas characterized by environmental conditions such as climate, landforms, and human activities that influence the character of specific habitat types.

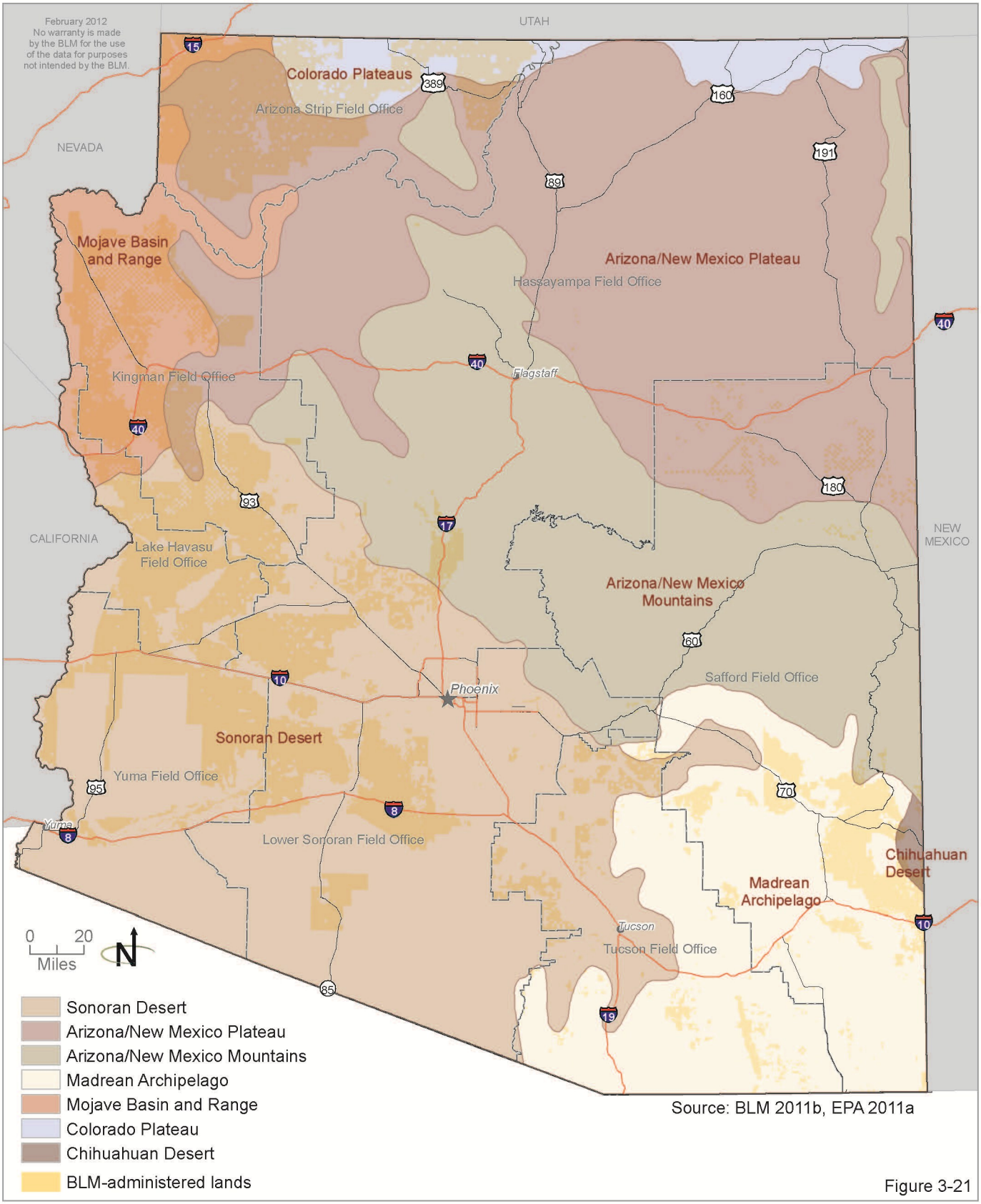


Figure 3-21

only found in a few high-elevation parts of this region. Chaparral is common on the lower elevations, pinyon-juniper and oak woodlands are found on lower and middle elevations, and the higher elevations are mostly covered with open to dense ponderosa pine forests. These mountains are the northern extent of some Mexican plant and animal species (EPA 2010b).

Madrean Archipelago

Also known as the Sky Islands in the United States, this is a region of basins and ranges with medium to high local relief, typically 3,000 to 5,000 feet. Native vegetation in the region is mostly grama-tobosa shrubsteppe in the basins and oak-juniper woodlands on the ranges, except at higher elevations where ponderosa pine is predominant. The region has ecological significance as both a barrier and a bridge between two major cordilleras of North America, the Rocky Mountains and the Sierra Madre Occidental (EPA 2010b).

Mojave Basin and Range

This ecoregion contains broad basins and scattered mountains that are generally lower, warmer, and drier than those of the Central Basin and Range. Its creosote bush-dominated shrub community is distinct from the saltbush–greasewood and sagebrush–grass associations that occur to the north in the Central Basin and Range and Northern Basin and Range; it also differs from the paloverde–cactus shrub and saguaro cactus that occur in the Sonoran Basin and Range to the south (EPA 2010b).

Chihuahuan Desert

This desert ecoregion extends from the Madrean Archipelago in southeastern Arizona to the Edwards Plateau in south-central Texas. The physiography is generally a continuation of basin and range terrain that is typical of the Mojave Basin and Range and the Central Basin and Range to the west and northwest, although the patterns of alternating mountains and valleys is not as pronounced as in the Mojave Basin and Range and the Central Basin and Range. Vegetative cover is predominantly desert grassland and shrubland, except on the higher mountains where oak, juniper, and pinyon woodlands occur. The extent of desert shrubland is increasing across lowlands and mountain foothills due to the gradual desertification caused in part by historical grazing pressure (EPA 2010b).

Sonoran Basin and Range

Similar in topography to the Mojave Basin and Range to the north, this ecoregion contains scattered low mountains and has large tracts of federally owned land, a large portion of which is used for military training. However, the Sonoran Basin and Range is slightly hotter than the Mojave and contains large areas of palo verde-cactus shrub and giant saguaro cactus, whereas the potential natural vegetation in the Mojave is largely creosote bush. Winter rainfall decreases from west to east, while summer rainfall decreases from east to west (EPA 2010b).

Vegetative Communities

Vegetative communities within Arizona, based on the SWreGAP, are presented in **Appendix F**, Southwest Regional GAP Analysis Project Landcover Types and Descriptions for Arizona (USGS National Gap Analysis Program 2004).

Riparian Communities

Riparian areas are the zones along water bodies that serve as interfaces between terrestrial and aquatic ecosystems. Riparian areas are most commonly associated with river and stream corridors, though riparian vegetation can also be found in marshes, wetlands, seeps, and springs, and along lakesides. They support a disproportionate amount of wildlife and vegetation and provide shade, wildlife cover, migratory corridors, foraging and nesting habitat, pollutant and sediment filtration, flood control, and stream bank stabilization. Riparian areas in the Sonoran Desert are considered to have among the richest breeding bird diversity and productivity in North America (AZGFD 2006).

Riparian vegetation within Arizona varies according to elevation, with three general groupings: below 3,500 feet; between 3,500 and 7,000 feet; and between 7,000 and 10,000 feet. Below 3,500 feet, ephemeral streams are common and support deep-rooted trees and shrubs, such as mesquite (*Prosopis* spp.), acacia (*Acacia* spp.), saltcedar (*Tamarix*s spp.), palo verde (*Parkinsonia* spp.), cottonwood (*Populus* spp.), willow (*Salix* spp.), and sycamore (*Platanus* spp.). Between 3,500 and 7,000 feet elevation, riparian vegetation is the most diverse and has the greatest canopy cover. Common species include cottonwood, willow, sycamore, ash (*Fraxinus* spp.), and walnut (*Juglans* spp.). Above 7,000 feet, vegetation representative of montane riparian communities is present, such as willow, chokecherry (*Prunus virginiana*), boxelder (*Acer negundo*), Rocky Mountain maple (*Acer glabrum*), and various conifer tree species (Hendricks 1985).

Drought, livestock grazing, and the spread of nonnative species are the major causes of negative impacts on riparian areas in Arizona (AZGFD 2006). Other sources of impacts are pollution, OHV use, diversions and impoundments, fire, and increasing population. Ponderosa pine encroachment is an issue in the Apache Highlands North ecoregion. Drought, diversions, and increasing populations reduce water availability for riparian vegetation, potentially making the vegetation more susceptible to disease or nonnative species invasion. Livestock may congregate in riparian areas, as they provide water and shade, and can therefore compact the soil, overbrowse seedlings, and trample vegetation. Nonnative species such as tamarisk (*Tamarix* spp.) and giant salvinia (*Salvinia molesta*) compete with native vegetation and remove water from the system. Polluted runoff may affect vegetation health, and OHV use compacts the soil and can destroy vegetation. Ash and silt resulting from upland fires can run off into riparian areas and create siltation problems (AZGFD 2006).

Rare Plant Communities

Rare plant communities occur within Arizona and may be either inherently rare or rare because of habitat alteration or degradation. The majority of inherently rare plant communities are relatively small patches of plants in unique combinations, often due to the presence of equally rare soil conditions. These patch communities occur within a matrix of more common, widespread community types and often serve as important biological niches. Often, the rare plant communities have been eliminated from REDA consideration because they occur in areas with known sensitive resources (**Table 2-1**, Area with Known Sensitive Resources (Eliminated from REDA Consideration)). However, it is likely that not all rare plant communities have been eliminated from REDA consideration. To protect these communities, site-specific evaluation would be conducted on a project-level basis, and vegetation management plans would be developed and implemented.

Invasive Species and Noxious Weeds

Invasive species are non-native species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Noxious weeds are a subgroup of invasive species. The Arizona Department of Agriculture regulates noxious weeds, which are defined as "any species of plant that is, or is liable to be, detrimental or destructive and difficult to control or eradicate and shall include any species that the director [of the plant services division of the Arizona Department of Agriculture], after investigation and hearing, shall determine to be a noxious weed" (ARS 3-201[4]). There are three categories of noxious weeds: 1) prohibited – species which are prohibited from entering the state, 2) regulated – species which may be controlled or quarantined to prevent further infestation or contamination, and 3) restricted – species which shall be quarantined to prevent further infestation or contamination (Arizona Department of Agriculture 2011). There are 55 prohibited species, 9 regulated species, and 16 restricted species, for a total of 80 noxious weeds (**Appendix E**, Arizona Department of Agriculture List of Prohibited, Regulated, and Restricted Noxious Weeds). In addition, there are over 100 federal noxious weeds that BLM must manage for in accordance with the regulations listed in the beginning of this section and numerous other organizations that track weeds, such as the Weed Science Society of America.

Surface-disturbing activities such as development or poorly managed livestock grazing can remove or damage native vegetation and facilitate the spread of invasive species. Thus, as surface-disturbing activities have increased in Arizona, so have weed spread and invasion. Large, catastrophic fires have destroyed native vegetation, and where left barren, weeds have often spread and taken over. In addition, overgrazed areas have damaged or removed native vegetation and are more susceptible to weed invasion, especially since weeds may be transported by livestock. State regulations and BLM policy have worked to reduce and prevent weed spread with varying degrees of success. Patch treatment has removed weeds in localized areas, but large-scale removal of

weeds is likely infeasible. Site-specific surveys are conducted on a project-level basis, and vegetation management plans and integrated weed management plans are developed. Together, these methods help to document and control weed populations.

3.21.2 Agua Caliente Solar Energy Zone Affected Environment

Vegetation within the proposed Agua Caliente SEZ is described using the same ecoregion and vegetation classifications as above. In addition, a biological reconnaissance site visit was conducted on August 2 and 3, 2011, within the proposed Agua Caliente SEZ.

The proposed Agua Caliente SEZ is within the Sonoran Desert ecoregion and is dominated by Sonora-Mojave Creosotebush-White Bursage Desert Scrub (see **Table 3-35**, Vegetation Types in the Proposed Agua Caliente SEZ). Elevations range from 150 to 220 feet. Species observed on-site during the site reconnaissance include creosotebush (*Larrea tridentata*), white bursage (*Ambrosia dumosa*), saguaro (*Carnegiea gigantea*), ocotillo (*Fouquieria splendens*), ironwood (*Olneya tesota*), ratany (*Krameria* spp.), brittlebush (*Encelia farinosa*), pencil cholla (*Opuntia arbuscula*), palo verde, fishhook barrel cactus (*Ferocactus wislizenii*), desert mistletoe (*Phoradendron macrophyllum*), and silver cholla (*Opuntia imbricata* var. *argentea*).

Table 3-35
Vegetation Types in the Proposed Agua Caliente SEZ

Vegetation Type	Acres
Agriculture	20
Invasive Southwest Riparian Woodland and Shrubland	240
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	20,270
Barren Lands, Non-Specific	0
North American Warm Desert Wash	0
Sonora-Mojave Mixed Salt Desert Scrub	0
Sonoran Paloverde-Mixed Cacti Desert Scrub	70
Total	*20,600*

Source: SWreGAP 2011

The proposed Agua Caliente SEZ has at least six wide ephemeral washes onsite, running north to south (see **Section 3.23**, Water Resources). Riparian vegetation, such as leguminous trees, is most abundant in three of these washes, Hoodoo Wash, Baragan Wash, and Clanton Wash. In addition, numerous small washes and braided channels occur throughout the proposed SEZ, particularly in the northern portion of the site.

Site-specific noxious weed and invasive species surveys were not conducted within the proposed SEZ. During the site visit, Russian thistle (*Salsola kali*), an unknown thistle, and one tamarisk (*Tamarix* sp.) shrub were observed. The tamarisk shrub was observed within Hoodoo Wash. No state-listed noxious

weeds were observed, but potentially occurring noxious weeds include field bindweed (*Convolvulus arvensis*), puncturevine (*Tribulus terrestris*), and red star-thistle (*Centaurea calcitrapa*), as these species have been recorded within Yuma County (NRCS 2011g).

3.22 VISUAL RESOURCES

This section describes visual resources in the planning area as well as regulations associated with visual resource management.

General Visual Setting

The planning area encompasses a wide variety of landscape types that can be categorized into ecological regions (or ecoregions). Attributes used to characterize an ecoregion include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology, all of which influence visual resources (EPA 2011b). Visual resources are generally homogenous within an ecoregion. Arizona is comprised of the following ecoregions: Colorado Plateaus, Arizona/New Mexico Plateau, Arizona/New Mexico Mountains, Madrean Archipelago, Mojave Basin and Range, Chihuahuan Desert, and Sonoran Basin and Range (see **Figure 3-21**, Level III Ecoregions) (EPA 2011b). See **Section 3.21**, Vegetation, for a description of each ecoregion.

Although the population is not evenly distributed across the planning area, human influences have altered much of the visual landscape, especially with respect to land use and land cover. In some places, intensive human activities, such as mineral extraction and energy development, have significantly altered the natural visual landscape. Large, fast-growing cities also contain heavily altered landscapes, with urban sprawl spreading into what were recently relatively undisturbed landscapes.

Visual Resource Management System

In accordance with FLPMA, the BLM is entrusted with the multiple-use management of natural resources on BLM-administered land, which contain many outstanding qualities, including scenic landscapes. The BLM's Visual Resource Management (VRM) system guides visual resources management on BLM-administered lands. Visual resources are defined as the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features). There are three stages of the VRM system: inventory (visual resource inventory), assigning VRM management classes, and analysis (visual resource contrast rating).

The visual resource inventory process provides BLM managers with a means for determining visual values. The process involves a scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones. The process is described in detail in BLM Handbook H-8410-1, Visual Resource Inventory (BLM 1986a). Based on these three factors, BLM-administered lands are placed into one of four visual resource inventory classes. These inventory classes represent the relative value of the visual resources, Classes I and II being the most valued,

Class III representing a moderate value, and Class IV being of least value. The inventory classes provide the basis for considering visual values in the RMP process. VRM classes are established through the RMP process for all BLM-administered lands. During the RMP process, the class boundaries are adjusted as necessary to reflect the resource allocation decisions made in RMPs.

Table 3-36, Acres of Arizona BLM Land by Visual Resource Inventory [VRI] Components, displays the acres of BLM land broken down into each of the four VRI components (i.e., scenic quality, sensitivity, distance zones, and VRI classification). Note that data for the Tucson Field Office are unavailable. Additionally, the methodology for inventorying visual resources varied, data for different field offices were provided in a variety of digital formats, some data were missing, and some data overlapped other data. As such, the total acres calculated for each of the VRI components is different from the total acres of BLM land in Arizona and also may be different from each other. This information is also displayed on **Figure 3-22**, Visual Resource Quality Rating, **Figure 3-23**, Visual Resource Sensitivity Levels, **Figure 3-24**, Visual Resource Distance Zones, and **Figure 3-25**, Visual Resource Inventory Class.

Table 3-36
Acres of Arizona BLM Land by Visual Resource Inventory Components

Scenic Quality		Sensitivity		Distance Zones		VRI Classification	
Category	**Acres**	**Category**	**Acres**	**Zone**	**Acres**	**VRI Class**	**Acres**
A	2,294,000	High	6,031,800	Foreground/ Middleground	7,145,500	Class I	1,134,000
B	4,458,200	Medium	2,993,200	Background	2,202,200	Class II	2,961,300
C	4,512,800	Low	2,292,100	Seldom Seen	2,125,200	Class III	2,933,400
Not Rated	421,700	Not Rated	421,700			Class IV	4,538,500
No Data	4,600	No Data	4,600			No Data	200
Total	*11,691,300*	*Total*	*11,743,400*	*Total*	*11,472,900*	*Total*	*11,567,400*

Source: BLM 2011b

Visual management objectives are predefined for each VRM class. The objectives for visual resources management classes on public lands are as follows:

- Class I. The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
- Class II. The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Visual Resource Quality Rating

Scenic Quality Evaluation measures the visual appeal of a landscape. Lands are rated as Class A, Class B, or Class C based on the apparent scenic quality. Scenic quality is determined by reviewing and rating lands using seven key factors (landform, vegetation, water, color, influence of adjacent scenery, and scarcity), and the total score determines the scenic quality rating.

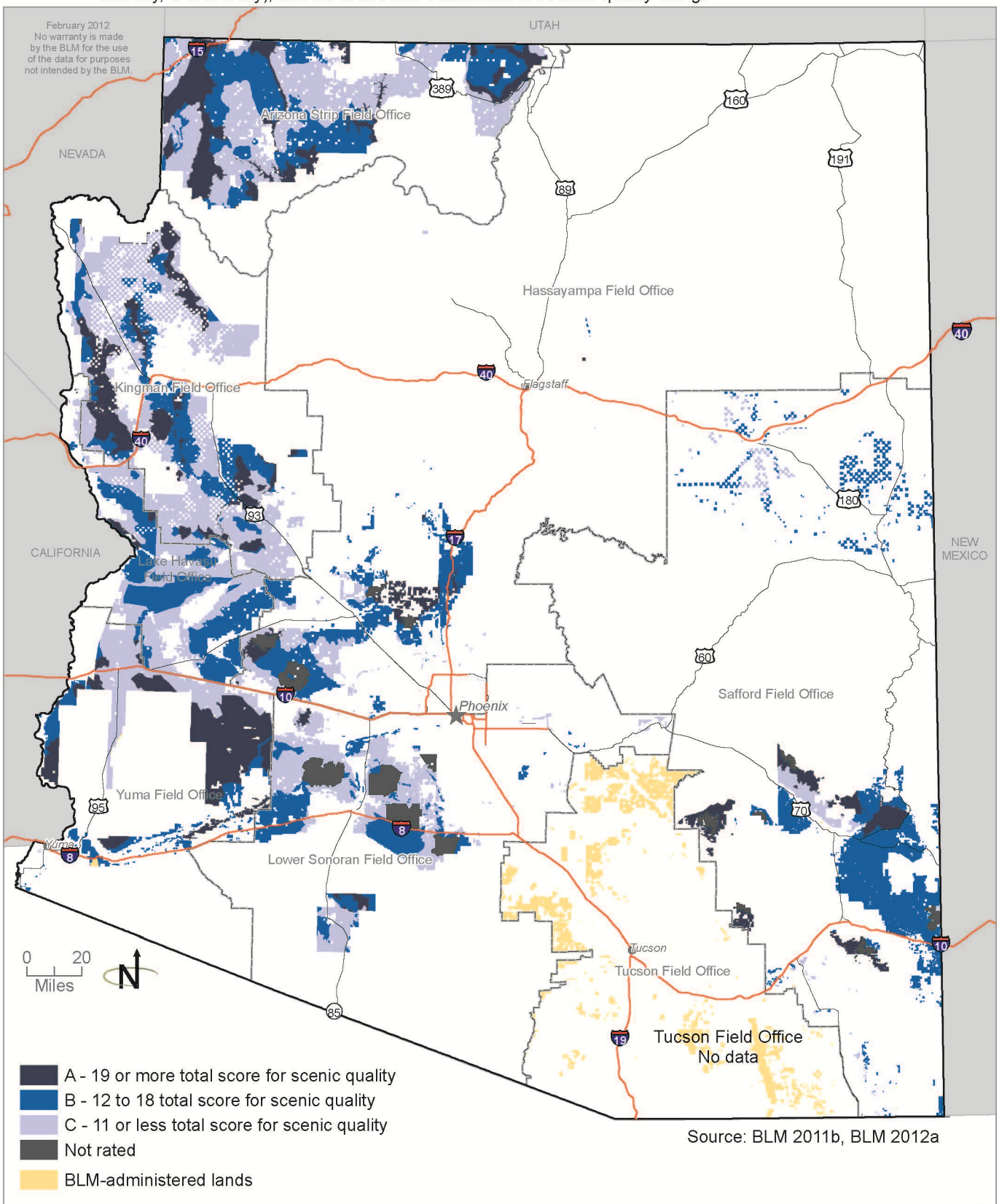


Figure 3-22

Visual Resource Sensitivity Levels

Sensitivity levels are a measure of public concern for scenic quality. Lands are assigned high, medium, or low sensitivity levels based on consideration of the following: types of users, amount of use, public interest, adjacent land uses, special areas, and other. The overall rating is not quantified; instead, the evaluators make a professional judgment about how the overall ratings valued.

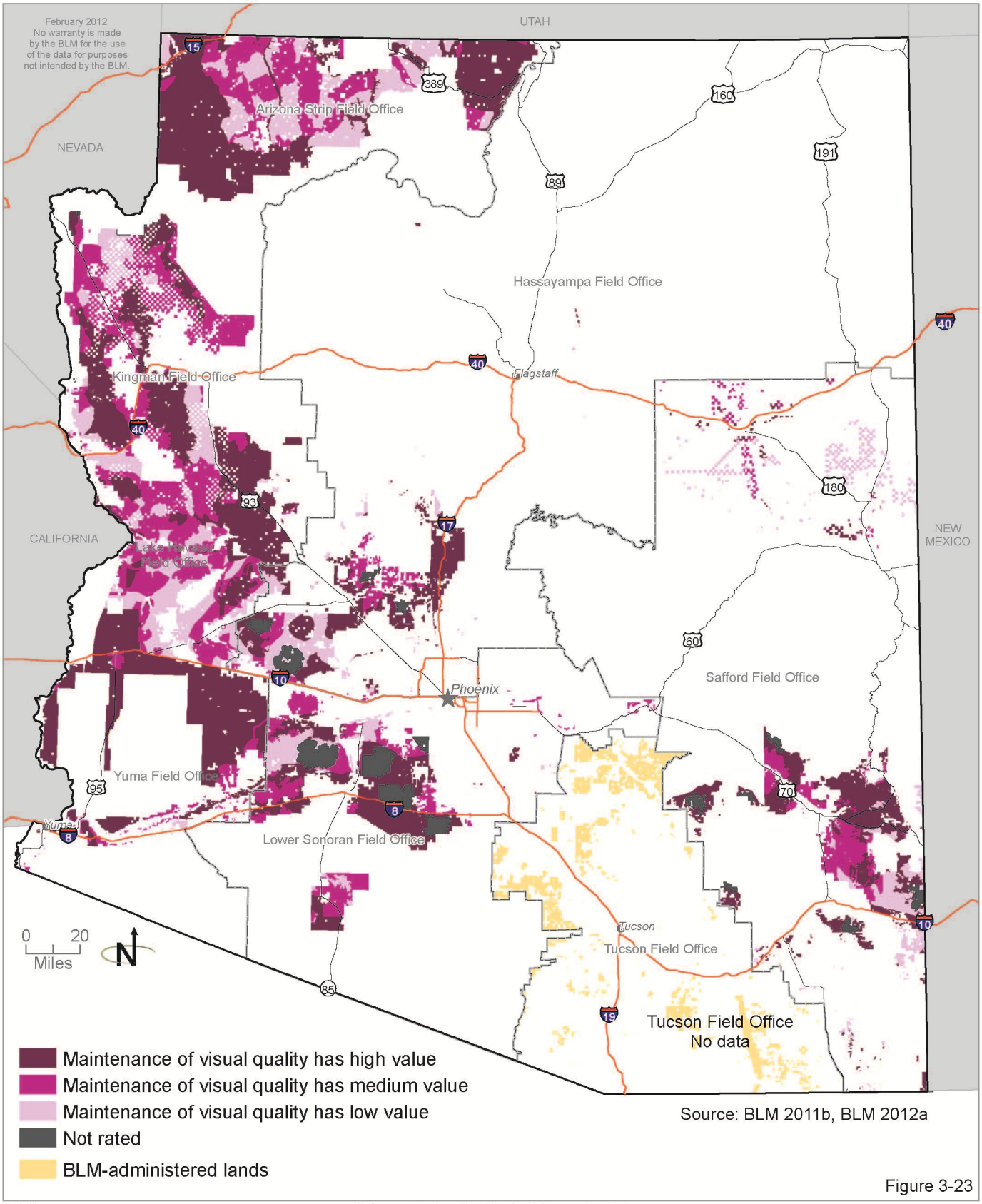


Figure 3-23

Visual Resource Distance Zones

Landscapes are divided into three distance zones: foreground, middleground, background, and seldom seen. The distance zones are based on relative visibility from travel routes or observation points. Details are more visible to the viewer in the foreground-middleground and are less visible in the seldom seen zone. Lands within the foreground/middleground may therefore be more sensitive to landscape changes.

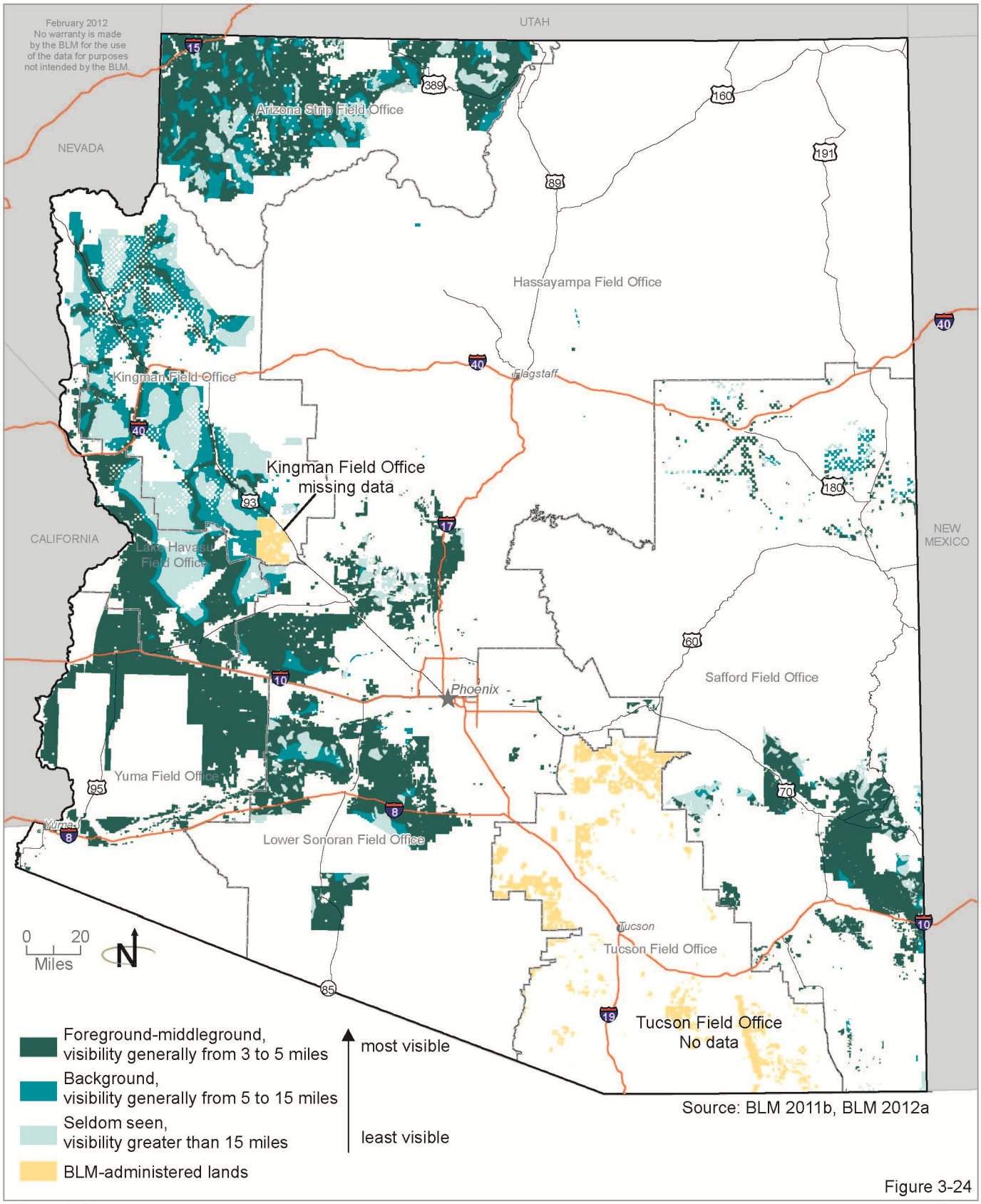
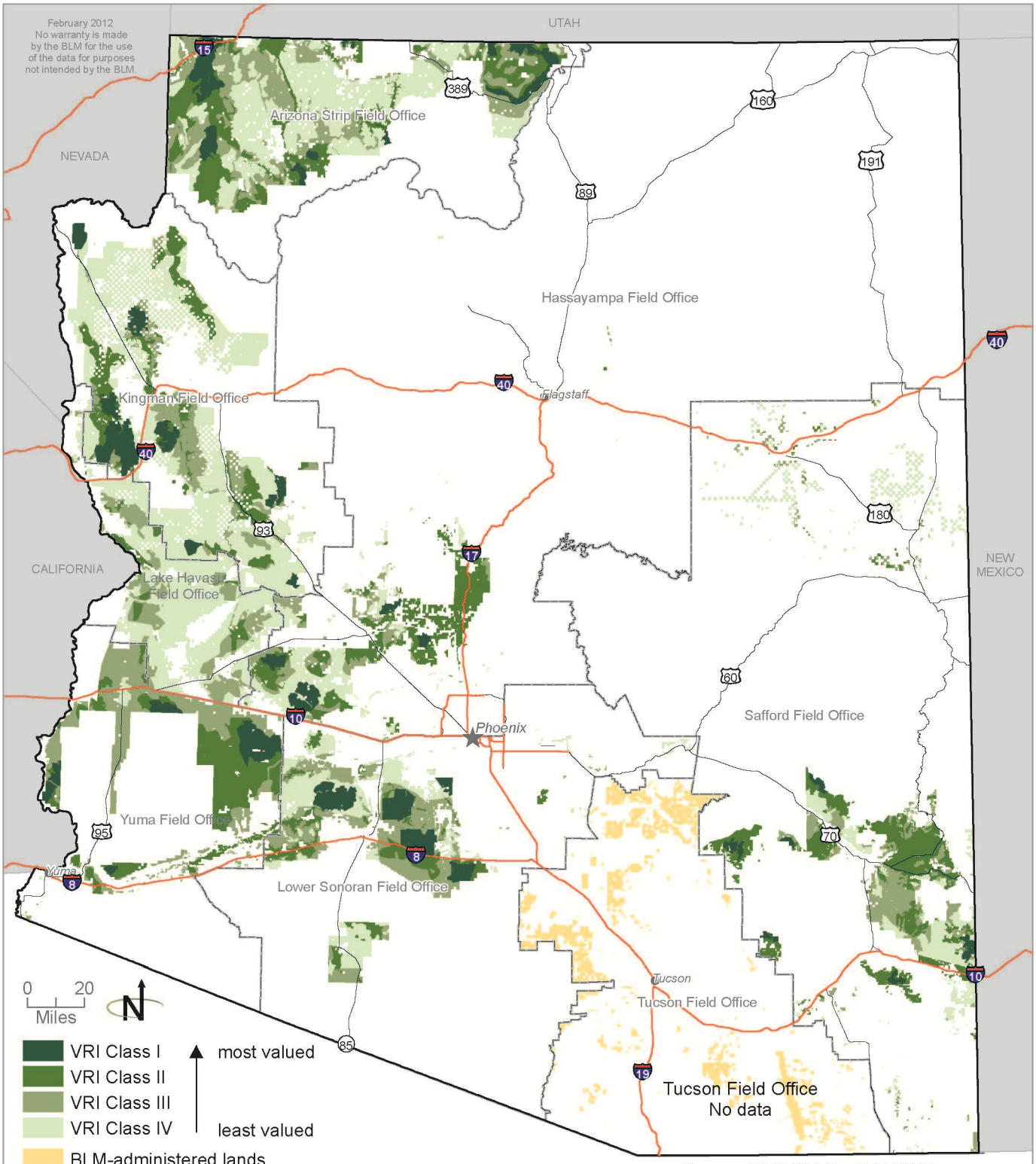


Figure 3-24

Visual Resource Inventory Class

Visual Resource Inventory Classes represent the relative value of the visual resources. Lands are placed into one of four classes based upon the results of visual resource contrast rating, sensitivity levels, and distance zones.



Source: BLM 2011b, BLM 2012a

VRI Class I is generally assigned to special areas such as national wilderness and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape.

Figure 3-25

- Class III. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- Class IV. The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

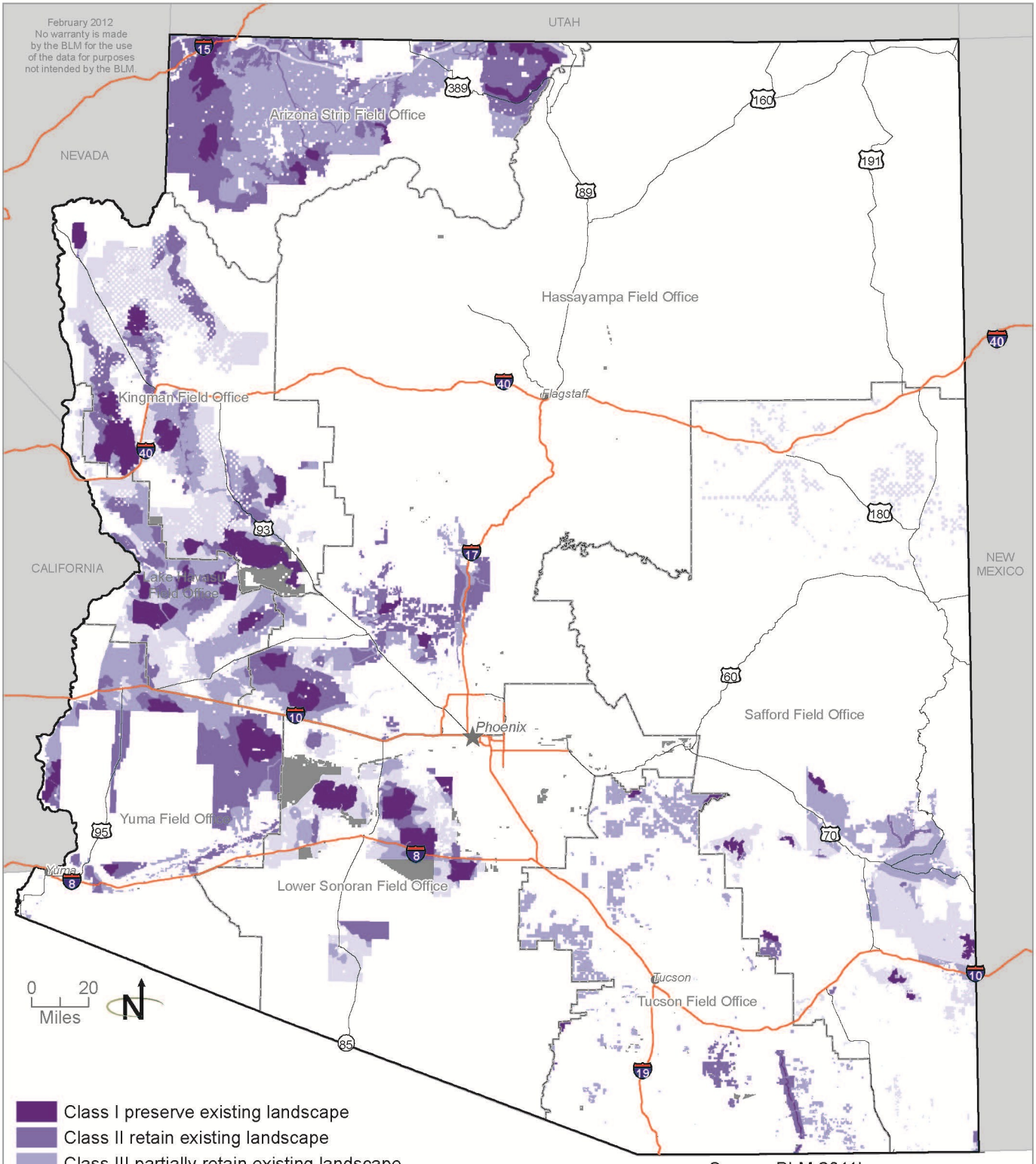
The analysis stage (visual resource contrast rating) involves determining whether the potential visual impacts from proposed surface-disturbing activities or developments will meet the management objectives established for the area, or whether design adjustments will be required. A visual contrast rating process is used for this analysis, which involves comparing the project features with the major features in the existing landscape using the basic design elements of form, line, color, and texture. The analysis is also influenced by the number of and proximity of receptors sensitive to visual resources. This process is described in BLM Handbook H-8431-1, Visual Resource Contrast Rating (BLM 1986b). The analysis can then be used as a guide for resolving visual impacts.

3.22.1 RDEP Affected Environment

Figure 3-26, Visual Resource Management, and **Table 3-37**, Visual Resource Management display the acres of each VRM Class on BLM-administered land in the planning area. Furthermore, approximately 1,650 acres in 8 nominated sites are managed as VRM Class II, and approximately 20,850 acres in 21 nominated sites are managed as VRM Class III.

Visual Resource Management

Visual resources are defined as the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features). A Visual Resource Inventory determines the quality of the visual resources and Visual Resource Management manages visual resources by categorizing them into management types (classes).



Source: BLM 2011b

Figure 3-26

Table 3-37
Visual Resource Management

Class	Acres	Percentage of BLM-administered Lands
I	1,497,200	12%
II	3,122,600	26%
III	4,085,500	34%
IV	3,216,700	26%
Undesignated or No Data	249,000	2%

Source: BLM 2011b

3.22.1 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ study area inventoried at Class III. It has a scenic quality rating of B, a sensitivity rating of medium, and is located in the foreground/middleground distance zone. During the RMP phase, it was decided that the area would be managed as VRM Class III (see **Figure 3-27**, Visual Resources in Proposed Agua Caliente SEZ). The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

The area immediately adjacent to the proposed Agua Caliente SEZ is managed as VRM Class II. The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

3.23 WATER RESOURCES

The following section describes water resources in the planning area. The majority of Arizona lies within the Lower Colorado River hydrologic region, with the exception of a small portion of the northeast corner of the state, north of Lees Ferry, which falls within the Upper Colorado hydrologic region.

Major Laws and Regulations

The Clean Water Act (CWA) established the basic structure for regulating discharges of pollutants into waters of the U.S., including setting water quality standards for all contaminants in surface waters. Under Sections 301 and 402, the CWA prohibits the discharge of any pollutant from a point source into navigable waters of the U.S. without a National Pollutant Discharge Elimination System (NPDES) permit issued by EPA, a state, or, where authorized, a tribal government on an Indian reservation. Permits under Section 402 are generally issued by the state in which the discharge originates. For discharge of dredged

Visual Resources in Proposed Agua Caliente SEZ

The proposed Agua Caliente SEZ study area inventoried at Class III. It has a scenic quality rating of B, has a sensitivity rating of medium, and is located in the foreground/middleground distance zone. During RMP planning, it was decided that the area would be managed as VRM Class III.

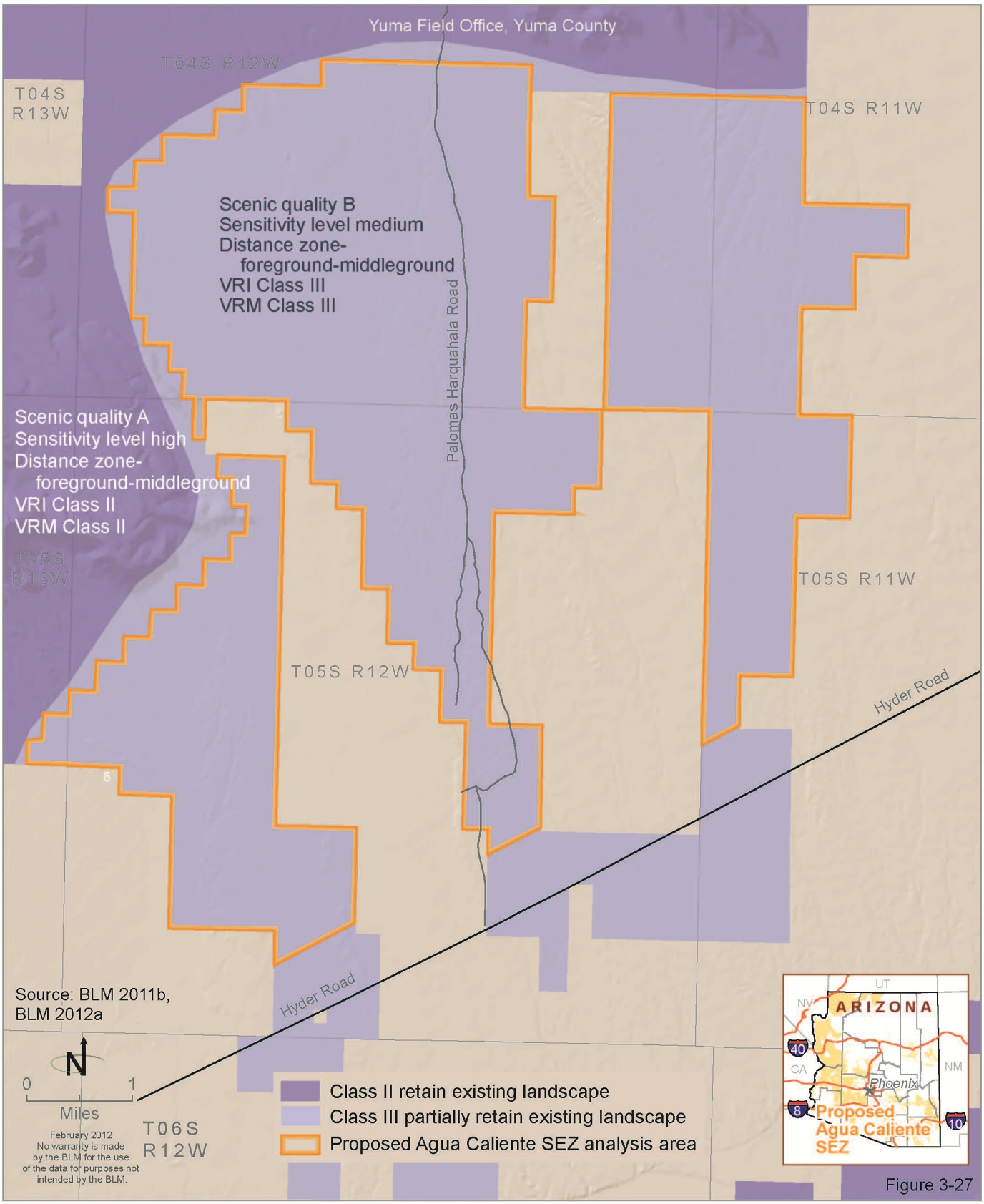


Figure 3-27

or fill material into Waters of the U.S., including wetlands, a Section 404 permit from the U.S. Army Corps of Engineers (USACE) is required. Under Section 401, the CWA requires the state to issue water quality certifications for discharges of fill and dredged material to waters of the state, including wetlands, headwaters, and riparian areas.

Executive Order 11990, Protection of Wetlands directs federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial value of wetlands in carrying out programs affecting land use.

Executive Order 11988, Floodplain Management, as amended by Executive Order 12148, directs each federal agency to take action to avoid the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are further required to avoid direct or indirect support of floodplain development whenever there is a practicable alternative.

Under the Safe Drinking Water Act (SDWA), the EPA sets drinking water standards referred to as the National Primary Drinking Water Regulations, 40 CFR Part 141, and the National Secondary Drinking Water Regulations, 40 CFR Part 143. These regulations set maximum contaminant levels (MCLs) for substances in drinking water and apply to groundwater if the groundwater is a source of potable water. Groundwater rights may be subject to federal regulation where a hydrologic connection exists with a federal reserved water right.

3.23.1 RDEP Affected Environment

Surface Water

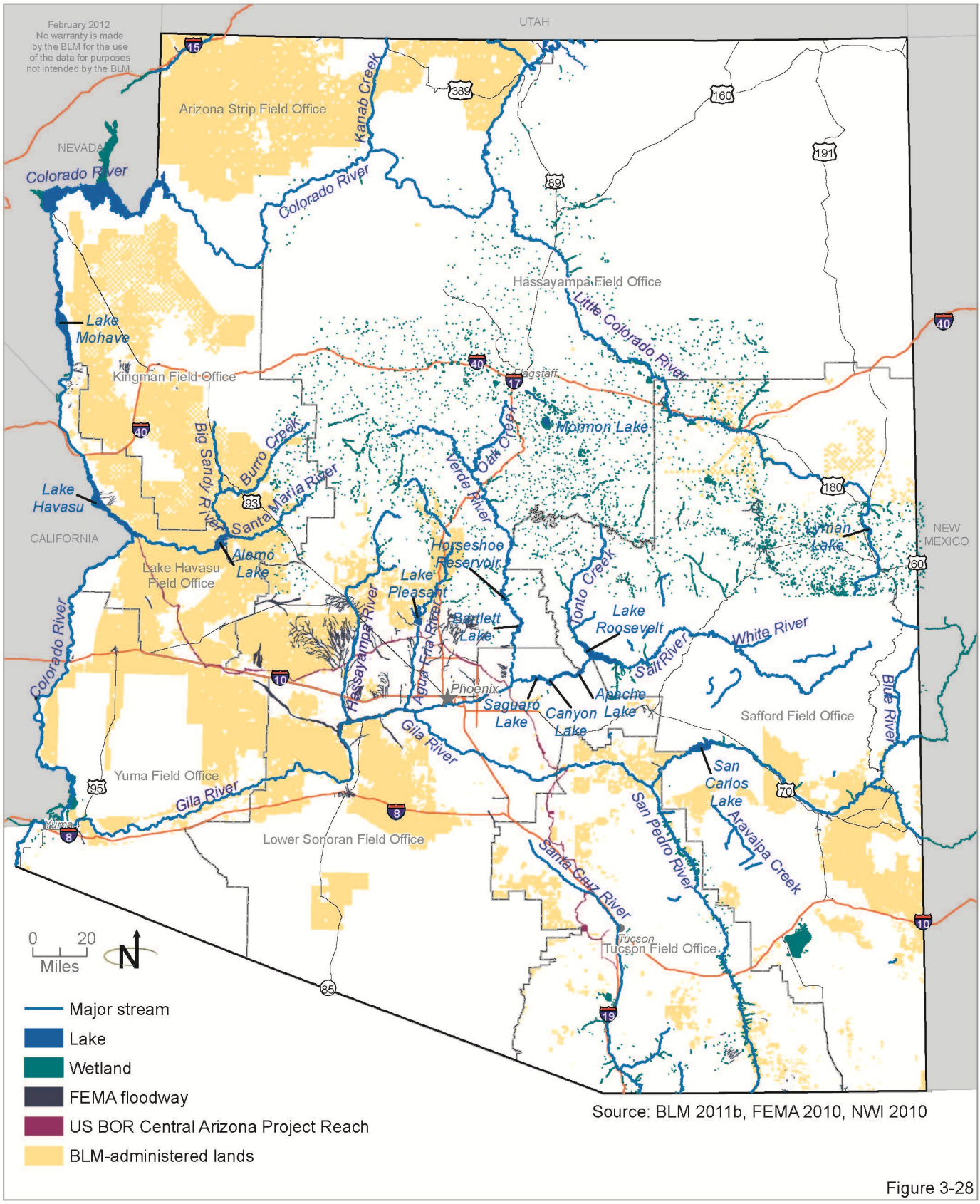
The Lower Colorado hydrologic region is comprised of the lower reaches of the Colorado River in the desert southwest of Arizona. The climate is arid, and precipitation is limited to the winter months and periods of heavy storms in the summer. Most precipitation during summer evaporates before it can infiltrate into the desert sands (BLM and Forest Service 2008).

Surface water flow in the arid basins of the Southwest is ephemeral to nonexistent most of the year. Spring snowmelt and periods of heavy winter rain result in surface water flow in the mountainous areas and along the intervening basins' mountain fronts. During the rest of the year, surface water flow is absent except after major storms, where flash floods are common along mountain fronts. Only major rivers draining the Colorado Plateau or the Mogollon Rim, such as the Gila, Salt, and Bill Williams Rivers, have perennial flow (BLM and Forest Service 2008).

Surface water resources that occur in the planning area include perennial, intermittent, and ephemeral streams; human created reservoirs; wetlands; and broad ephemeral washes. Surface water resources are shown on **Figure 3-28**, Surface Waters.

Surface Waters

Surface waters in Arizona include perennial, intermittent, and ephemeral streams, human-created reservoirs, wetlands, and broad ephemeral washes.



Source: BLM 2011b, FEMA 2010, NWI 2010

Figure 3-28

Wetlands are often associated with perennial water sources such as springs, perennial segments of streams, lakes, or ponds. Wetlands are considered a valuable ecological resource because of their important roles in providing fish and wildlife habitat, maintaining water quality, and controlling floods. Total wetland area present based on estimates from 1980 is 600,000 acres in Arizona, accounting for 0.8 percent of the state's surface area. As throughout the U.S., wetlands in the western states have experienced a major decline in abundance because of human disturbance; however, data show a recent net gain in wetland acreage (BLM and Forest Service 2008). Wetlands occur in the planning area.

BLM Priority Watersheds

BLM Arizona developed a water strategy to identify risks to water quality, water quantity, groundwater-dependent ecosystems, and riparian areas for maintaining properly functioning watershed conditions. These risks contribute to declines in the ability to sustain the living rivers in Arizona.

BLM Arizona conducted a statewide assessment using interagency data and expertise to identify priority streams based on trends, including water quality, water quantity, anthropogenic threats, and condition of water-dependent resources such as riparian wildlife and aquatic species. Based on this assessment, the BLM Arizona water strategy established ten priority watersheds on BLM-administered lands (BLM 2011j). The priority watersheds, shown on **Figure 3-29**, Priority Watersheds, Sole Source Aquifers, and Irrigation Non-expansion Areas, include the Upper San Pedro, Bill Williams, Lower San Pedro, Agua Fria, Lower Colorado, Upper Gila, Big Sandy, Hassayampa, Santa Maria, and Kanab watersheds.

The priority watershed program is an effort by the BLM to provide leadership to engage local watershed organizations, communities, conservation interests and natural resource agencies to ensure active development and implementation of protection and restoration efforts for priority watersheds (BLM 2011n).

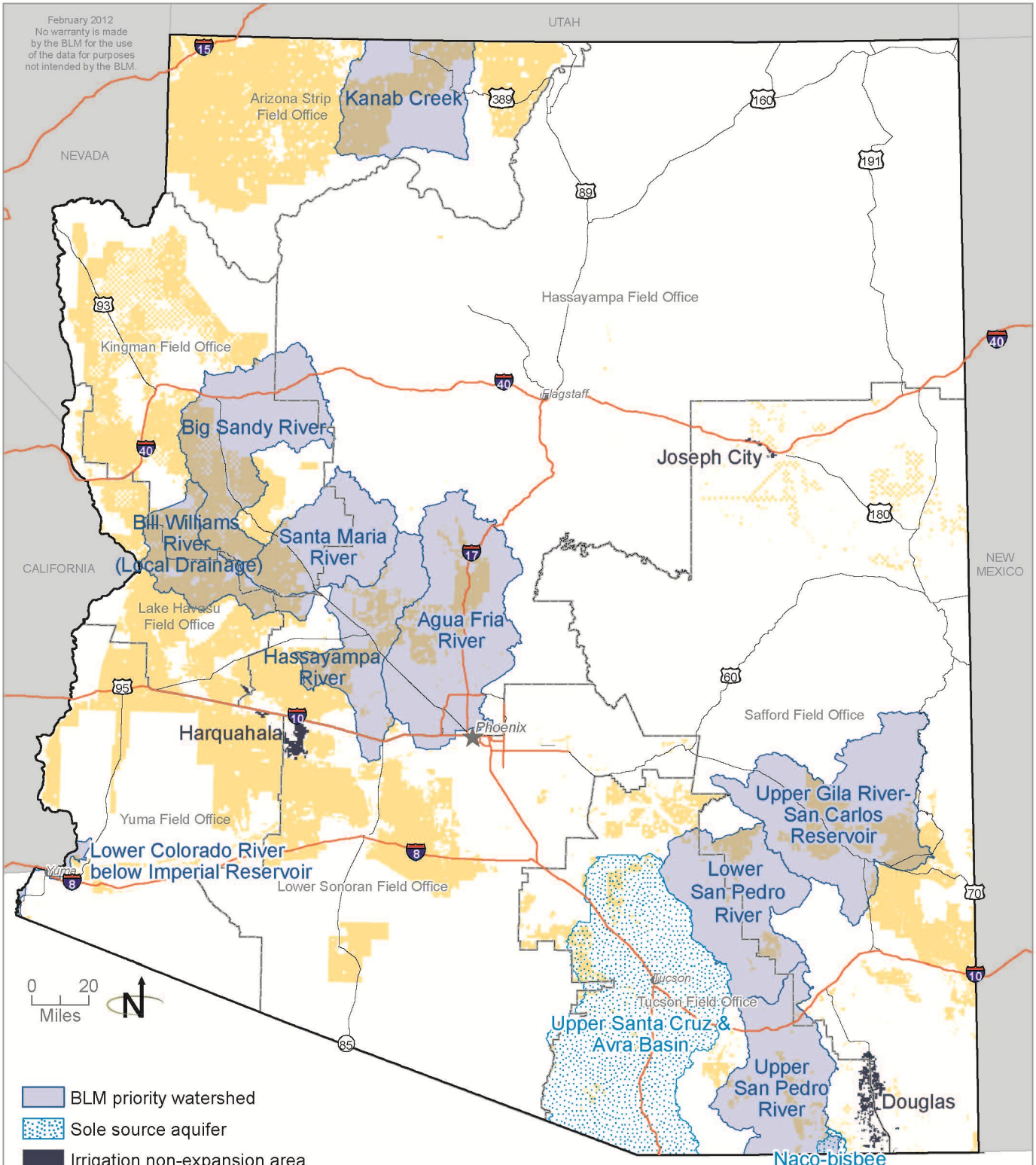
Groundwater

Groundwater is recharged by precipitation in the mountains and infiltration of streamflow along the base of the mountains. Groundwater aquifers are used extensively for irrigation and domestic consumption. Cultural uses (agriculture, industry, and municipal) have substantially lowered the water levels in the groundwater aquifers of the Arizona basins (BLM and Forest Service 2008).

The water levels and direction of groundwater movement in a basin are determined by the geometry of the bedrock surrounding the basin and by the location and quantity of recharge and discharge within the basin. Although groundwater flows through the basin-fill aquifers from areas of recharge to areas of discharge, the complex and partly interconnected network of aquifers in the basins causes groundwater to flow in many different directions, and the hydrology of each basin is unique (USGS 1995).

Priority Watersheds, Sole Source Aquifers, and Irrigation Non-Expansion Areas

The Arizona BLM Water Strategy established 10 priority watersheds that are at risk. A sole source aquifer supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. Irrigation non-expansion areas have restrictions on increasing the number of irrigated acres in the area.



Source: ADWR 2010a and 2010b, BLM 2011b, EPA 2010a

Figure 3-29

Groundwater Basins

A majority of Arizona is within the Basin and Range aquifers, which occupy approximately 200,000 square miles of the southwestern U.S. and underlie most of Nevada, southeastern California, southeastern Oregon, southeastern Idaho, western Utah, southeastern Arizona, and southwestern New Mexico. (USGS 1995).

Arizona is organized into 7 planning areas containing 51 groundwater basins (**Figure 3-30**, Arizona DWR Planning Areas and Groundwater Basins. The planning areas and the groundwater basins within those planning areas are as follows:

- Active Management Areas (AMAs): Phoenix, Pinal, Prescott, Santa Cruz, and Tucson AMAs;
- Central Highlands: Agua Fria, Salt River, Tonto Creek, Upper Hassayampa, and Verde River;
- Eastern Plateau: Little Colorado River;
- Lower Colorado River: Butler Valley, Gila Bend, Harquahala, Lower Gila, McMullen Valley, Parker, Ranegras Plain, San Simon Wash, Tiger Wash, Western Mexican Drainage, and Yuma;
- Southeastern Arizona: Aravaipa Canyon, Bonita Creek, Cienega Creek, Donnelly Wash, Douglas Basin, Dripping Springs Wash, Duncan Valley, Lower San Pedro, Morenci, Safford, San Bernardino Valley, San Rafael, Upper San Pedro, and Wilcox;
- Upper Colorado River: Big Sandy, Bill Williams, Detrital Valley, Hualapai Valley, Lake Havasu, Lake Mojave, Meadview, Peach Springs, and Sacramento Valley;
- Western Plateau: Coconino Plateau, Grand Wash, Kanab Plateau, Paria, Shivwitz Plateau, and Virgin River.

Sole Source Aquifers

The EPA defines a sole or principal source aquifer as an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas may have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend on the aquifer for drinking water. For convenience, all designated sole or principal source aquifers are referred to as "sole source aquifers" (SSA) (EPA 2011f).

- There are two sole source aquifers in Arizona: the Upper Santa Cruz and Avra Basin, and the Bisbee-Naco Aquifer. The Upper Santa Cruz and Avra Basin was designated in 1984, and the Bisbee-Naco Aquifer was designated in 1988 (EPA 2011f). These two sole source aquifers are shown on **Figure 3-29**, Priority Watersheds, Sole Source Aquifers, and Irrigation Non-expansion Areas.

Arizona DWR Planning Areas and Groundwater Basins

Arizona is organized into seven water planning areas and 51 groundwater basins.

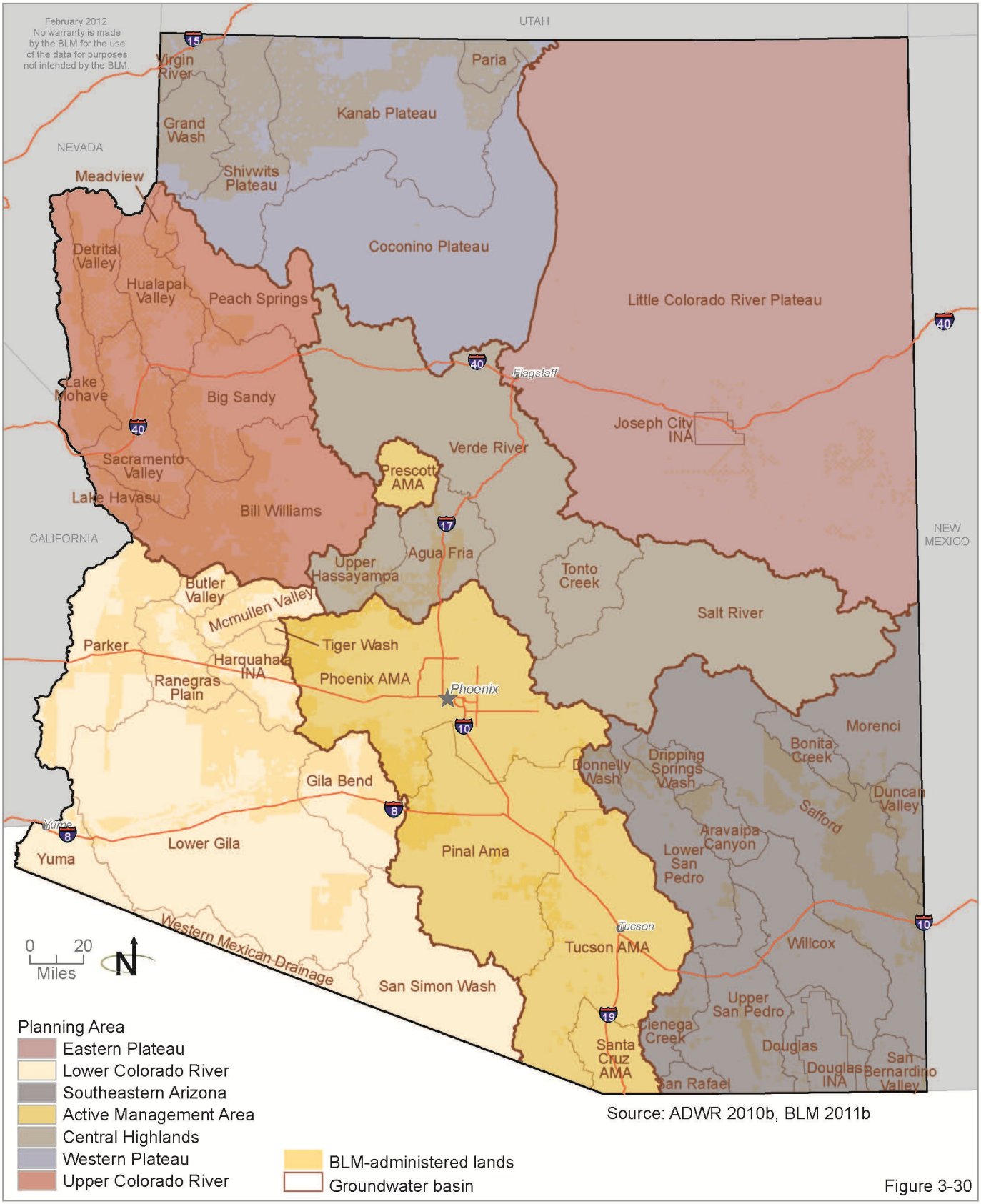


Figure 3-30

Active Management Areas

The 1980 Arizona Groundwater Management Code recognized the need to aggressively manage the state's finite groundwater resources to support the growing economy. Areas with heavy reliance on mined groundwater were identified and designated as AMAs. There are five AMAs: Prescott, Phoenix, Pinal, Tucson, and Santa Cruz. These areas are subject to regulation pursuant to the Groundwater Code. Each AMA carries out its programs in a manner consistent with these goals, while considering and incorporating the unique character of each AMA and its water users (ADWR 2011). The five AMAs are located in the southern and central parts of Arizona and are shown on **Figure 3-31**, Active Management Areas.

In the Phoenix, Prescott, and Tucson AMAs, the primary management goal is safe-yield by the year 2025 by natural or artificial means. Safe-yield is accomplished when no more groundwater is being withdrawn than is being annually replaced.

In the Pinal AMA, where the economy is primarily agricultural, the management goal is to preserve that economy for as long as feasible, while considering the need to preserve groundwater for future non-irrigation uses.

In the Santa Cruz AMA, the management goal is to maintain a safe-yield condition in the AMA and to prevent local water tables from experiencing long-term declines (ADWR 2011).

Irrigation Non-Expansion Areas

The 1980 Arizona Groundwater Management Code initially established two Irrigation Non-expansion Areas (INA): Joseph City and Douglas. Since the law was passed, the Harquahala area has also been designated as an INA. When an area is designated as an INA, a restriction is placed on increasing the number of irrigated acres in the area (ADWR 2011). The INAs in Arizona are shown on **Figure 3-29**, Priority Watersheds, Sole Source Aquifers, and Irrigation Non-expansion Areas.

Groundwater Quality

The most common contaminants found in Arizona groundwater in concentrations above health-based drinking water standards are arsenic, fluoride, radioactive elements, and nitrate (Arizona Cooperative Extension 2009). Nitrate is one of the most common pollutants in Arizona's groundwater and is associated with both natural and human activities such as percolation of nitrate-laden water from irrigation, septic tanks, wastewater treatment plants, and concentrated feedlots (Rahman and Uhlman 2009).

Active Management Areas

Areas with heavy reliance on mined groundwater were identified and designated as Active Management Areas by the 1980 Arizona Groundwater Code and are subject to restrictions.

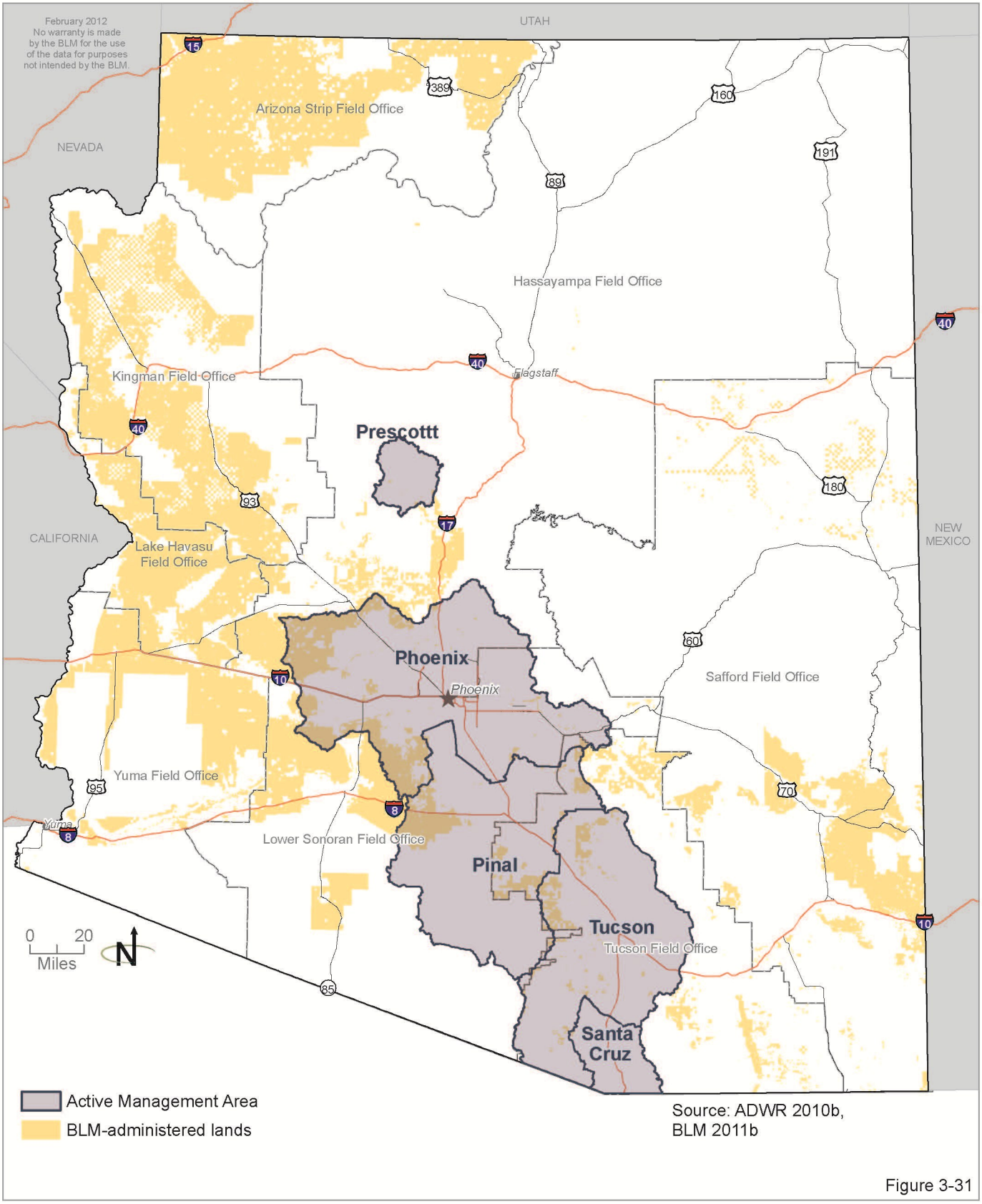


Figure 3-31

In general, Arizona groundwater quality is influenced by the nature of the bedrock, elevated levels of total dissolved solids and salinity in alluvium or in areas with Late Tertiary sedimentary bedrock, and elevated metals in groundwater in mining areas. Good water quality occurs in deep, carbonate aquifers (BLM and DOE 2010).

3.23.2 Agua Caliente Solar Energy Zone Affected Environment

The Agua Caliente SEZ is within the Basin and Range physiographic province. The hydrology within the proposed SEZ is complex, and this section is limited to a general overview of prominent surface and subsurface hydrology features. The proposed SEZ is situated on a south-facing hillslope landform atop alluvial fan features associated with the Palomas Mountains and Baragan Mountain. The proposed SEZ land surface is scoured by a braided series of washes and ephemeral streams. The ephemeral streams and washes flow in a southerly direction through the proposed SEZ and out the southern analysis boundary, eventually discharging to the Gila River.

Surface Water

The Agua Caliente SEZ has at least six wide ephemeral washes on site and a network of minor braided ephemeral streams that discharge into the ephemeral washes (see **Figure 3-9**, Important Resources in Proposed Agua Caliente SEZ). National Wetland Inventory maps do not identify mapped wetlands within the proposed SEZ analysis area. The analysis area likely has jurisdictional ephemeral waters of the U.S. due to the drainage patterns observed on aerial photographs and area USGS topographic maps.

The proposed Agua Caliente SEZ is outside all identified BLM priority watersheds (shown on **Figure 3-29,** Priority Watersheds, Sole Source Aquifers, and Irrigation Non-expansion Areas).

Groundwater

Based on the proposed SEZ analysis area's topography and aerial photographs, the direction of groundwater flow is to the south, towards the Gila River. The proposed SEZ analysis area is in the Lower Colorado Planning Area in the Lower Gila groundwater basin. Groundwater occurs in both recent stream alluvium and basin fill. Groundwater development in the eastern part of the Lower Gila Basin is in the broad alluvial plains that border the Gila River, where the main aquifer is the upper sandy unit in the basin fill. Groundwater is primarily unconfined.

Prior to development, groundwater flow was from north and southeast toward the Gila River and then downstream to the southwest. Historically, cones of depression occurred in irrigated areas north of Hyder, east of Dateland, and in the Palomas Plain west of Hyder. Infiltration of irrigation water in the western part of the basin has created groundwater mounds in the floodplain aquifer that also affect groundwater flow. Groundwater recharge is primarily from infiltration of runoff in washes and the Gila River floodplain. Underflow from the

Painted Rock Dam on the eastern basin boundary, as well as releases from the dam during floods, also contribute to groundwater recharge.

Groundwater levels in the Gila River floodplain in the western part of the basin historically ranged from 10 to 20 feet below land surface. The streambed alluvium was the primary source of groundwater. As irrigation activity increased in the 1930s, groundwater levels declined and salinity increased.

Historic groundwater level declines were as much as 15 feet per year in irrigated areas north and west of Hyder and east of Dateland. Few water level change measurements are available for the period 1990-1991 to 2004-2005, but several measured wells in the western part of the basin show relatively stable water level conditions.

Groundwater quality varies in the eastern part of the basin, with elevated fluoride concentrations measured in a number of wells. In the western part of the basin, the quality of groundwater in the Gila River floodplain is unsuitable for most uses, with elevated total dissolved solids concentrations common, as well as fluoride and arsenic (ADWR 2009).

Water Rights and Supply

Potential water supply sources at the proposed Agua Caliente SEZ include surface water and groundwater. Renewable energy developers must apply for and obtain the appropriate state permits and approvals to pump groundwater or appropriate surface water. ADWR records indicate the existence of surface water rights in proximity to the Agua Caliente SEZ that are primarily for irrigation use. Other listed uses include domestic and stockwatering. There are also two inactive public drinking water supply wells located outside of the proposed SEZ (ADWR# 55-602947 and 55-602948). Any proposed groundwater wells or surface water diversions would be subject to review and approval by ADWR.

3.24 WILD HORSES AND BURROS

The Wild Free-Roaming Horses and Burros Act (United States Code, Title 16, Section 1331 et seq. [16 USC 1331 et seq.]) of 1971 gave the BLM and other federal land management agencies the responsibility to protect, manage, and control wild horses and burros.

The general management objectives for wild horses and burros are to 1) protect, maintain, and control viable, healthy herds with diverse age structures while retaining their free-roaming nature; 2) provide adequate habitat through the principles of multiple use and environmental protection; 3) maintain a thriving natural ecological balance with other resources; 4) provide opportunities for the public to view wild horses and burros; and 5) protect wild horses and burros from unauthorized capture, branding, harassment, or death.

The areas that were in use as habitat by wild horses or burros at the time the 1971 Wild Free-Roaming Horses and Burros Act was passed as known as herd areas (HAs). A subset of these areas have been determined suitable for long-term management of wild horses and burros and are known as herd management areas (HMAs). Horses and burros within HMAs are managed with the goal of maintaining a thriving natural ecological balance on public lands. Both HAs and HMAs can include private or state lands, but BLM has management authority only over public lands (BLM 2011g). HAs and HMAs in the planning area are shown on **Figure 3-32**, Wild Horse and Burros.

3.24.1 RDEP Affected Environment

In Arizona, the BLM manages two wild horse herds totaling approximately 430 head in the Cerbat Mountains (within Cerbat and Cibola-Trigo HMAs), located between Interstate-8 and Interstate-10, including Yuma Proving Ground north of the city of Yuma. In addition, the BLM manages around 2,800 head of wild burros roaming public lands in seven HMAs and three HAs. The appropriate management level (i.e., the maximum number of animals sustainable on a year-long basis) is, however, only 1,676 animals (BLM 2011g). **Table 3-38**, Wild Horse and Burro Statistics shows the HAs, HMAs, and populations for wild horses and burros in the planning area.

Table 3-38
Wild Horse and Burro Statistics

Herd Area Acres (FY 2009)	
BLM	2,019,932
Herd Management Area Acres (FY 2009)	
BLM	1,756,086
Population (2011)	
Horses	434
Burros	2,761
Total	3,195
Total AML	1,676

Source: BLM 2010i, BLM 2011g

Due to a lack of predators, in the absence of management action, wild horse and burro populations will continue to increase in size (BLM 2011b). Data collected from Yuma, Arizona, however, indicates a lower rate of increase. The ecosystems of public rangelands are not able to withstand the impacts from overpopulated herds, which include soil erosion, sedimentation of streams, and damage to wildlife habitat.

As a result, the agency must remove animals from the range each year to short-term corrals, long-term pastures, and through the adoption program in order to control herd sizes. Additionally, the BLM is investigating the use of contraceptives and other population suppression techniques to control

Wild Horse and Burros

Wild horse and burros are managed within herd management areas (HMAs) with the goal of maintaining the natural ecological balance of public lands as well as the ability to support multiple herds. HMAs can include private or state lands, but the BLM has management authority only over BLM-administered lands.

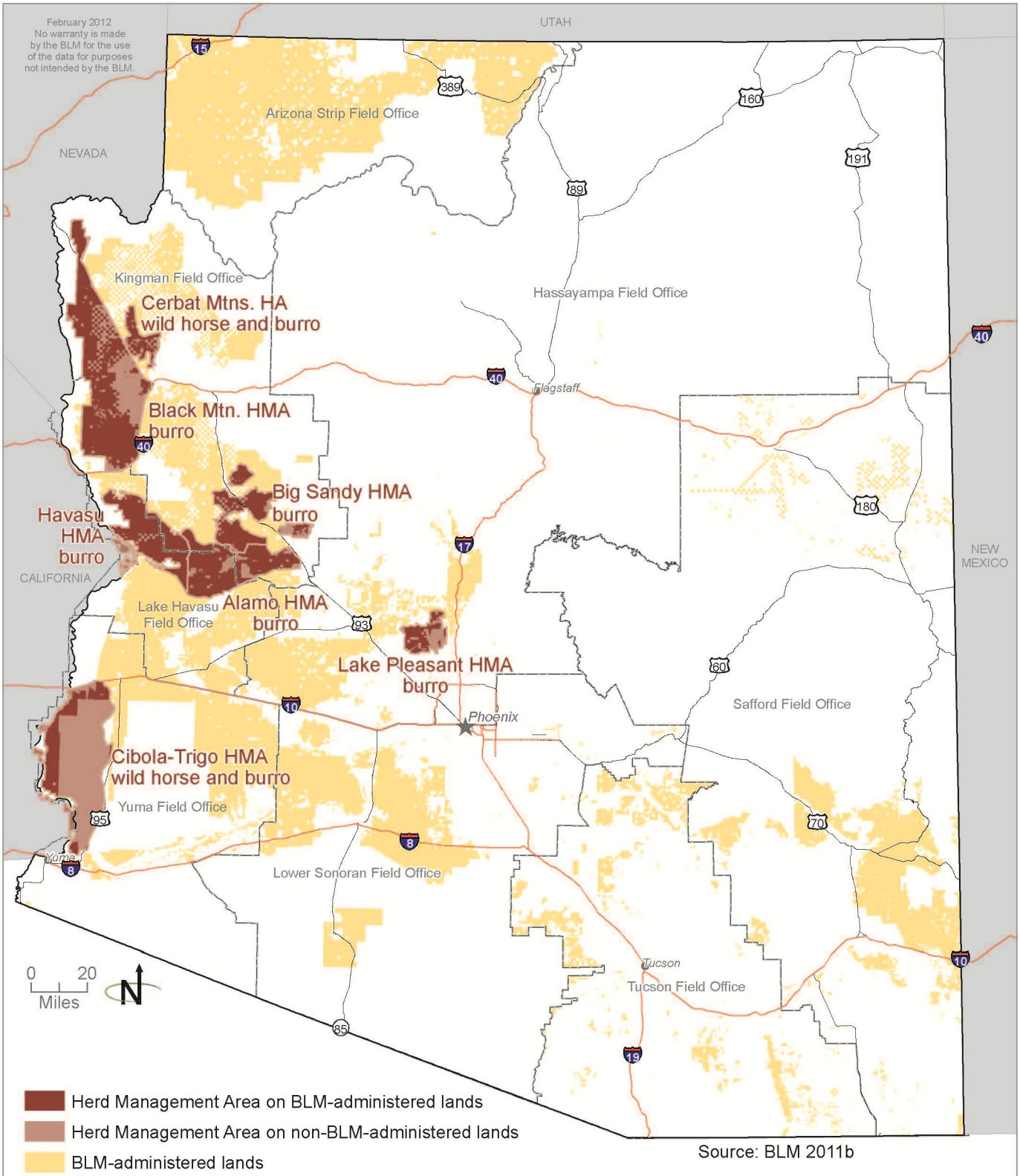


Figure 3-32

population sizes. Arizona, however, removes very few wild horses; only about 75 have been removed from the range in the last 10 years. The BLM is in the process of developing a comprehensive long-term plan and policy for management of wild horses and burros. The aim for this plan is to promote sustainable management of wild horse and burro populations (BLM 2010i).

3.24.2 Agua Caliente Solar Energy Zone Affected Environment

The proposed Agua Caliente SEZ is not within a current HMA or HA. Wild horses and burros would not be impacted by the proposed SEZ.

3.25 WILDERNESS CHARACTERISTICS

The BLM's authority to conduct wilderness reviews, including the establishment of new WSAs, expired on October 21, 1993, pursuant to Section 603 of the FLPMA. However, the BLM has retained authority under Section 201 of the FLPMA to inventory BLM-administered lands for wilderness characteristics and to consider such information during land use planning. Through the RMP process, the BLM has discretion to determine which portions of BLM-administered lands with wilderness characteristics would be protected under special management. However, the BLM cannot manage these areas under the nonimpairment standard described in the BLM's Interim Management Policy for Lands under Wilderness Review (BLM Handbook H-8550-1 [BLM 1995]), which applies only to WSAs.

The process, outlined in Instruction Memorandum 2011-154, entails the identification of wilderness inventory units, an inventory of roads and wilderness characteristics, and a determination of whether or not the area meets the overall criteria for wilderness character, including size, naturalness, outstanding opportunities for solitude or a primitive and unconfined type of recreation, and other supplemental values (e.g., ecological, geological, or other features of scientific, educational, scenic, or historical value). Units found to possess such character are evaluated during the land use planning process to address future management. The BLM may decide to either protect the areas to maintain the wilderness characteristics or to consider the wilderness characteristics during implementation-level planning but not place primary management emphasis on their protection.

Wilderness characteristics inventories have been updated for the Arizona Strip District and the Hassayampa, Lake Havasu, Yuma, and Lower Sonoran Field Offices as part of recent RMP revision efforts. The Kingman, Safford, and Tucson Field Offices have not yet undergone RMP revisions. As such, the most recent field office-wide wilderness characteristics inventories for these field offices date back to 1980 when a BLM-wide inventory was performed. All areas identified as having wilderness characteristics during that inventory became WSAs. Subsequent legislation designated 47 Wilderness areas on BLM-administered land in Arizona and also released all but 2 WSAs from Wilderness consideration (PL 98-406 and PL 101-628).

Lands released from Wilderness consideration may still contain wilderness characteristics; the findings are reflected in the updated inventories for the Arizona Strip District and the Hassayampa, Lake Havasu, Yuma, and Lower Sonoran Field Offices. However, these lands may not have been reinventoried if they are within the Kingman, Safford, and Tucson Field Offices. These field offices will perform field office-wide inventory updates as part of future RMP revisions. Some wilderness characteristics inventories have been performed in the Kingman, Safford, and Tucson Field Offices in response to project proposals. Such inventories are localized to the project area.

Because of limited data for the Kingman, Safford, and Tucson Field Offices, the acres reported below and used in the impacts analysis are only for the Arizona Strip District and the Hassayampa, Lake Havasu, Yuma, and Lower Sonoran Field Offices. As the inventories are updated, RMPs would be amended accordingly.

3.25.1 RDEP Affected Environment

In the planning area, 2,036,700 acres of BLM-administered land outside of existing Wilderness and WSAs have been inventoried and found to have wilderness characteristics. Of those, 424,800 acres have been identified for management to maintain the wilderness characteristics (see **Figure 3-33**, Lands with Wilderness Characteristics).

3.25.2 Agua Caliente Solar Energy Zone Affected Environment

There are 9,400 acres of lands that have been inventoried and found to have wilderness characteristics within the proposed Agua Caliente SEZ. However, none of the lands are managed for wilderness characteristics protection in the Yuma Field Office RMP (see **Figure 3-34**, Lands with Wilderness Characteristics and the Juan Bautista de Anza National Historic Trail in Proposed Agua Caliente SEZ).

Lands with Wilderness Characteristics

Lands with wilderness characteristics are lands outside of existing Wilderness and WSAs that have been inventoried by the BLM and found to contain wilderness characteristics. During the BLM RMP process, the BLM decided to maintain wilderness characteristics on some lands containing wilderness characteristics and not others.

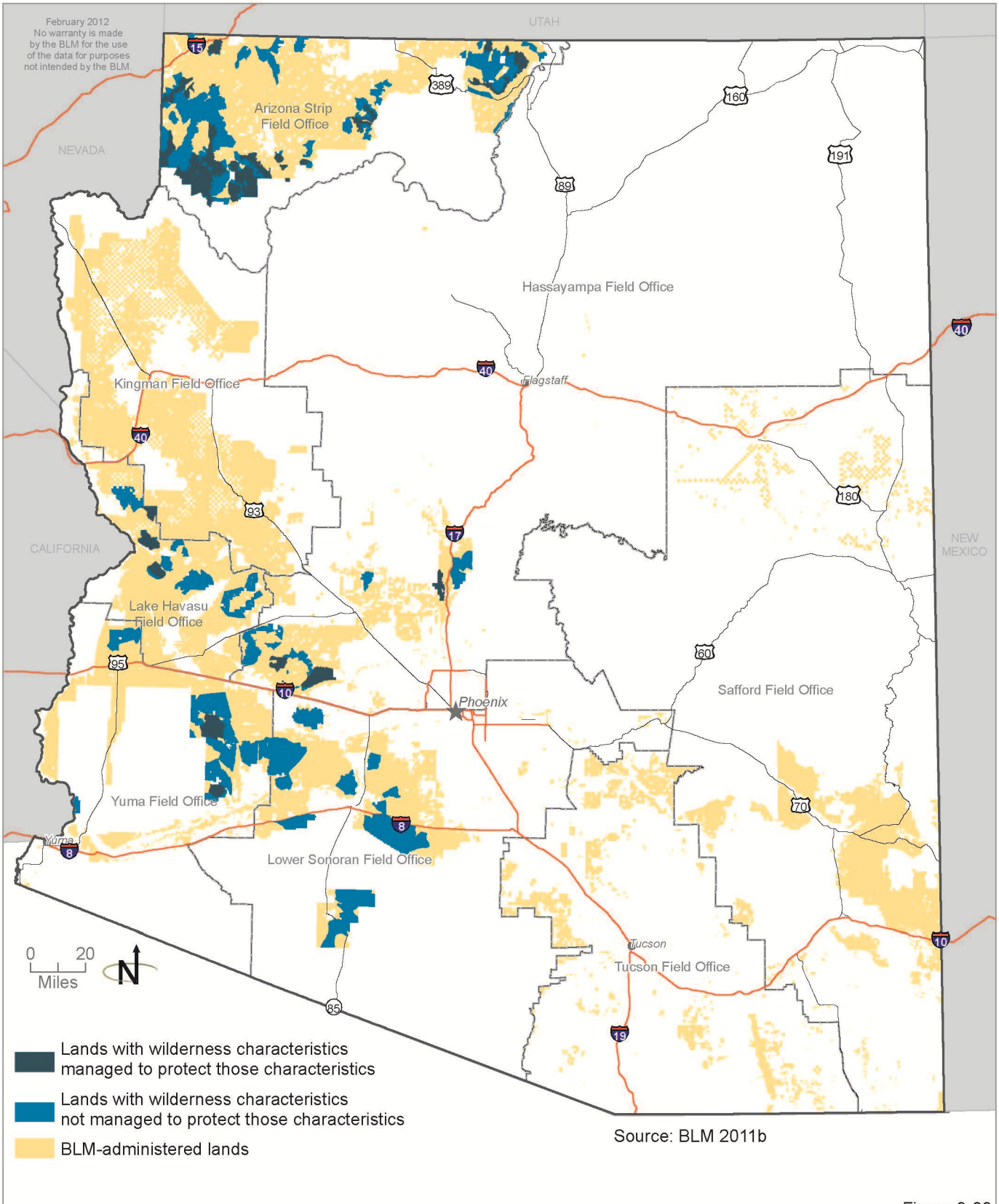


Figure 3-33

Lands with Wilderness Characteristics and the Juan Bautista de Anza National Trail in Proposed Agua Caliente SEZ

Lands with wilderness characteristics are lands outside of existing Wilderness and WSAs that have been inventoried by the BLM and found to contain wilderness characteristics. During the BLM RMP process, the BLM decided to maintain wilderness characteristics on some lands containing wilderness characteristics and not others.

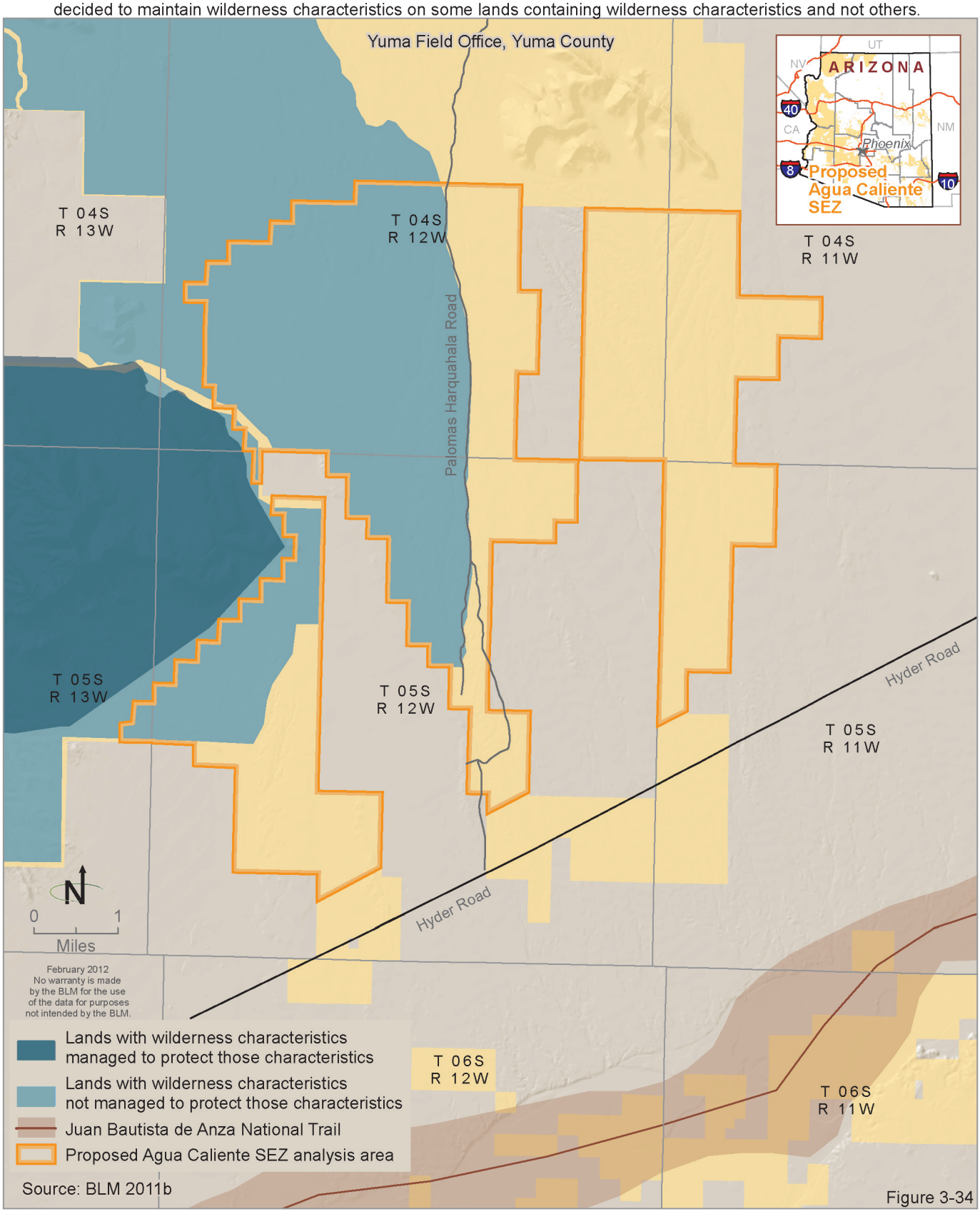


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CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter presents the likely direct, indirect, and cumulative impacts on the human and natural environment that could occur from implementing the alternatives presented in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. This chapter is organized by topic, similar to **Chapter 3**, Affected Environment. Each topic area includes a method of analysis section that identifies indicators, methods, and assumptions; a summary of effects common to all alternatives; and an analysis of impacts for each of the four alternatives. Separate sections describing cumulative impacts and irretrievable or irreversible commitment of resources are presented at the end of the chapter.

Many management actions proposed in Chapter 2 are planning-level decisions and do not result in direct impacts or on-the-ground changes. However, by planning for future potential renewable energy development on BLM-administered lands during the 20-year planning horizon, the analysis focuses on the indirect impacts that could eventually result from on-the-ground changes. This impact analysis identifies impacts that may result in some level of change to the resource, regardless of whether that change is beneficial or adverse. The impact analysis will not include a subjective qualifier (beneficial or adverse) to the impact; instead, it will state the nature, magnitude and/or context for the change (see **Section 4.1.2**, General Methodology for Analyzing Impacts, for more detail). The evaluations presented in this section are confined to the actions that have more prominent, immediate, or direct effects. Some of the proposed management actions, allocations, and potential future development may affect only certain resources and alternatives. If an activity or action is not addressed in a given section, no impacts are expected, or the impact is expected to be negligible based on professional judgment.

The BLM manages public lands for multiple uses in accordance with the FLPMA. Land use decisions are made to protect the resources while allowing for different uses of those resources, such as energy and mineral development, OHV use, recreation, and livestock grazing. When there are conflicts among resource uses or when a land use activity could result in unacceptable or irreversible impacts on the environment, the BLM may restrict or prohibit some land uses in specific areas. To ensure that the BLM meets its mandate of multiple use in land management actions, the impacts of the alternatives on resource users are identified and assessed as part of the RDEP planning process. The projected general impacts that are common to all alternatives are characterized and evaluated under an "Impacts Common to All Alternatives" heading under each resource and resource use topic; specific impacts related to the actions within an alternative are addressed under that specific alternative's section.

Impact analysis is a cause-and-effect process. The detailed impact analyses and conclusions are based on the BLM planning team's knowledge of resources and the planning area, reviews of existing literature, and information provided by experts in the BLM, other agencies, interest groups, and concerned citizens. The baseline used for the impact analysis is the current condition or situation, as described in **Chapter 3**, Affected Environment. Impacts on resources and resource uses are analyzed and discussed in detail commensurate with resources issues and concerns identified throughout the process. At times, impacts are described using ranges of potential impacts or in qualitative terms.

4.1.1 Scoping Comments on Resources and Resource Uses

During the scoping period for the RDEP, the BLM received numerous comments from the public requesting that the BLM consider the impacts on resources and resource uses and include descriptions of the mitigation measures that would avoid or lessen impacts. Following are the topics and issues that BLM will address in the impact analyses:

- Ensure that renewable energy policy and projects are carefully managed to maximize clean energy benefits while minimizing impacts on wildlands, wildlife habitat, clean air and water, recreation, and the many other resources and values found on our public lands.
- Consider wildlife habitat values, water resources, cultural resources, economic impacts, and scenic value as additional criteria to be analyzed in the EIS.
- Identify environmentally sensitive areas and areas with potential use conflicts, including 1) areas that contain threatened or endangered species, 2) migratory bird flyways, 3) aquatic resources, including wetlands and other Waters of the U.S., 4) bodies of water listed on the CWA 303(d) list, 5) ambient air

conditions and criteria pollutant nonattainment areas, 6) sole-source aquifers, 7) paleontological resources, 8) large residential areas nearby, and 9) military bases or areas with air and ground traffic. Include measures to either exclude these areas from development or identify appropriate stipulations to protect the resources.

- Quantify the potential environmental effect of each alternative to the greatest extent possible (for example, acres of wetlands impacted and tons per year of emissions produced).
- Identify landscape-level mitigation measures to minimize unacceptable impacts on sensitive resources in the surrounding landscape.
- Incorporate recommendations from the AZGFD May 2009 "Guidelines for Reducing Impacts to Wildlife from Wind Energy Development in Arizona."
- There are four nominated sites in northern Arizona that are near known locations or habitat for two federally listed plants and one candidate species. Desert tortoises occur near the Silvercreek Landfill nominated site.
- Consider whether a degraded site serves as wildlife habitat or a corridor. Some lands, even though degraded, can facilitate important dispersal movements for wide-ranging species.
- Limit qualified lands to only specific categories of significantly and permanently disturbed areas or parcels that render their cultural resource values beyond repair.
- Comply with NHPA Section 106, including cultural resource surveys and tribal consultation, even on previously disturbed parcels.
- Address Executive Order 13007, Indian Sacred Sites, and discuss how the BLM will avoid adversely affecting the physical integrity, accessibility, or use of any sacred sites.
- How will the BLM assess impacts on surface water and groundwater in the EIS analysis?
- Analyze the potential for alternatives to cause adverse impacts on aquatic resources, such as impacts on water quality and aquatic habitats.
- Describe the natural drainage patterns at the sites and areas, the drainage patterns of the areas during project operations, and whether any components of the proposed project would be within a 50- or 100-year floodplain.

- Describe existing restoration and enhancement efforts for CWA Section 303(d) waters in a project area.
- Avoid project activities in the Arizona Strip to allow for wilderness and recreation.
- Protect the San Pedro River Valley watershed from all intensive infrastructures.

There were also numerous comments received related to socioeconomics and environmental justice. Commenters suggested BLM implement the RDEP in a way that strengthens state and local socioeconomic conditions, provides local access to energy, ensures environmental justice, and protects human health and safety. Specific socioeconomic and environmental justice scoping issues are identified below:

- Discuss each alternative's potential to impact air traffic and safety in the vicinity of the proposed project.
- Given the size of many of the sites identified (less than 2,000 acres), there could be opportunities to advance community- or neighborhood-scale renewable energy development projects (for example, less than 100-MW capacity with a single end user of the power generated, not necessarily onsite).
- In the event that technology provides a better source of power, taxpayers must not bear the financial burden to remove the old technology.
- Discuss the economic benefits from a project (for example, to property taxes).
- Areas that can be restored and leased for grazing rights should be.
- Fifty percent of the generated power must remain in the state.
- Siting clean energy on previously disturbed or contaminated sites prevents unnecessary development of lands with other resources and values and can improve community well-being by cleaning up contamination and blight, benefiting local taxes, and bringing economic opportunities.
- How will the BLM ensure that disturbed sites (such as mineral sale/lease sites and mine sites) will accommodate public works projects? It is increasingly difficult to locate and permit aggregate sources.
- Evaluate environmental justice populations within the geographic scope of a project. Where populations exist, address the potential for disproportionate adverse impacts on minority and low-income populations, and the approaches used to foster public participation by these populations.

- Clarify what general measures will be incorporated to ensure that OHV and other users are not injured due to hazards associated with exposed collectors, piping, and transmission lines. Implement some safety precautions.

4.1.2 General Methodology for Analyzing Impacts

Potential impacts or effects[1] are described in terms of type, context, duration, and intensity, which are generally defined as follows:

- *Type of Impact* – Because types of impacts can be interpreted differently by different people, this chapter does not differentiate between beneficial and adverse impacts (except in cases where such characterization is required by law, regulation, or policy). The presentation of impacts for key planning issues is intended to provide the BLM decision maker and reader with an understanding of the multiple use tradeoffs associated with each alternative.
- *Context* – Context describes the area or location (site-specific, local, planning area-wide, or regional) in which the impact would occur. Site-specific impacts would occur at the location of the action, local impacts would occur within the general vicinity of the action area, planning area-wide impacts would affect a greater portion of the state, and regional impacts would extend beyond the planning area (state) boundaries.
- *Duration* – Duration describes the length of time an effect would occur, either short term or long term. Short term is defined as anticipated to begin and end within the first five years after the action is implemented. Long term is defined as lasting beyond five years to the end of or beyond a 20-year RDEP planning horizon.
- *Intensity* – This analysis discusses impacts using quantitative data wherever possible. If quantitative analysis is not possible, qualitative statements are used.
- *Direct and Indirect Impacts* – Direct impacts are caused by an action or implementation of an alternative and occur at the same time and place. Indirect impacts result from implementing an action or alternative but usually occur later in time or are removed in distance and are reasonably certain to occur.
- *Cumulative Impacts* – Cumulative impacts are described in **Chapter 5**, Cumulative Impacts. Cumulative impacts are the direct and indirect effects of a proposed project alternative's incremental impacts when they are added to other past, present, and reasonably foreseeable actions, regardless of who carries out the

[1] In the NEPA context, the terms "impacts" and "effects" are synonymous and interchangeable.

action (40 CFR Part 1508.7). The list of actions used for cumulative impact analysis is provided in **Section 5.1.2**, Past, Present, and Reasonably Foreseeable Future Actions.

Analysis shown under an alternative may be referenced in the other alternatives with such statements as "impacts would be the same as, or similar to, Alternative 2" or "impacts would be the same as Alternative 1, except for . . ." as applicable.

Irreversible and irretrievable commitment of resources, unavoidable adverse impacts, and the relationship of short-term uses of the environment to long-term productivity are discussed in **Section 4.3**. Each of these impacts discussions is required by the CEQ NEPA regulations at 40 CFR 1502.16 and summarizes information for resources and/or resources uses that may be affected.

The scope of the analysis focuses on impacts on resources and uses on BLM lands only, as the decisions being made by the BLM Arizona apply only to BLM-managed resources and uses. It may be that the characteristics and types of impacts when developing renewable energy projects on BLM-managed resources and uses would be similar to impacts on non-BLM managed resources and uses found on state lands, private lands, or lands managed by other federal agencies. Therefore, the type of impacts anticipated from renewable energy development may be useful to these other agencies and private land owners in understanding project development.

4.1.3 Analytical Assumptions

Several assumptions were made to facilitate the analysis of the projected impacts. These assumptions set guidelines and provide reasonably foreseeable projected levels of development that would occur within the RDEP planning area and timeframe. These assumptions should not be interpreted as constraining or redefining the management objectives and actions proposed for each alternative, as described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. The following general assumptions apply to all resource categories. Any specific resource assumptions are provided in the methods of analysis section for that resource.

- Several resources have been identified as an "Area with Known Sensitive Resources" in Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources (Eliminated from REDA Consideration). As such, these lands have been eliminated from consideration as a REDA; therefore, negligible impact on the listed resources is anticipated.
- The nominated sites described in **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites, do not have high quality/grade resources due to their disturbed nature.

- Sufficient funding and personnel would be available for implementing the final decision.
- Implementing actions from any of the alternatives would be in compliance with all valid existing rights, federal regulations, BLM policies, and other requirements.
- Additional site-specific NEPA and environmental analysis will be conducted on individual applications.
- The RDEP RFDS (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona) estimates that approximately 8,000 acres of land would be required to produce 1 GW of solar energy electricity, and 28,000 acres of land (10 percent of which would be disturbed) would be required to produce 1 GW of wind energy electricity.
- Based on the RFDS, the majority of BLM-administered land that is developable for solar energy projects occurs in the western half of Arizona, with smaller areas identified to the east; large tracts of land with no known technical or regulatory conflicts are identified along Interstates 8 and 10 to the west of Phoenix, and in the north, south, and west of Highway 389.
- Based on the RFDS, relatively few areas of BLM-administered lands are considered developable for wind energy projects across Arizona. No BLM-administered lands were found to contain the highest class of wind resources (Class 7), and only 69 acres were found to contain the second highest class of resources (Class 6).
- Direct and indirect impacts of implementing the RDEP decisions primarily occur on the public lands administered by the BLM Arizona.
- Local climate patterns of historic record and related conditions for plant growth would continue.
- In the future, as tools for predicting climate change in a management area improve and changes in climate affect resources and necessitate changes in how resources are managed, the BLM may be able to reevaluate decisions made as part of this planning process and adjust management accordingly.
- Appropriate maintenance would be carried out to maintain the functional capability of all developments.
- The discussion of impacts is based on the best available data. Knowledge of the planning area and professional judgment, based on observation and analysis of conditions and responses in similar areas, are used to infer environmental impacts where data are limited.

- Stipulations would apply, where appropriate, to all surface-disturbing activities (and occupancy) associated with land use authorizations, grants, and permits issued on BLM lands.
- Acreage figures and other numbers used in the analyses are approximate projections for comparison and analytic purposes only. Readers should not infer that they reflect exact measurements or precise calculations. Acreage calculations are rounded to the nearest hundred for the REDAs, and to the nearest 10 for the proposed Agua Caliente SEZ.

4.1.4 Incomplete or Unavailable Information

The CEQ established implementing regulations for NEPA requiring that a federal agency identify relevant information that may be incomplete or unavailable for an evaluation of reasonably foreseeable significant adverse effects in an EIS (40 CFR 1502.22). If the information is essential to a reasoned choice among alternatives, it must be included or addressed in an EIS. Knowledge and information is, and would always be, incomplete, particularly with complex ecosystems considered at various scales.

The best available information pertinent to the decisions to be made has been used in developing this EIS. Considerable effort has been taken to acquire and convert resource data into digital format for use in the EIS, both from BLM and from outside sources.

Certain information was unavailable for use in developing this plan because inventories have either not been conducted or are not complete. Some of the major types of data that are incomplete or unavailable include the following:

- Field inventory of soils and water conditions;
- Field inventory of vegetation composition;
- Field inventory of wildlife and special status species occurrence and condition; and
- Surveys for cultural and paleontological resources.

For these resources, estimates were made concerning the number, type, and significance of these resources based on previous surveys and existing knowledge. In addition, some impacts cannot be quantified given the proposed management actions. Where this gap occurs, impacts are projected in qualitative terms or, in some instances, are described as unknown. Subsequent project-level analysis will provide the opportunity to collect and examine site-specific inventory data required to determine appropriate application of the land use plan-level guidance. In addition, ongoing inventory efforts by BLM and other agencies in the planning area continue to update and refine information used to implement the RDEP.

4.2 RESOURCES AND RESOURCE USES

4.2.1 Air Quality and Air Quality-related Values

Evaluation Methodology, Resource Indicators, and Assumptions

The potential effects of renewable energy development were evaluated by assessing the effects that anticipated future actions consistent with the alternatives would have on air quality in the planning area. Because wind and solar technologies produce minimal air emissions during operation, the air quality analysis focuses primarily on impacts associated with their development, including construction activities and reclamation/abandonment activities. The analysis discusses short-term localized effects of development in relation to existing air quality conditions, site conditions, and meteorological conditions, as the effects of development, especially large-scale surface disturbance, are highly dependent upon these factors.

In addition to identifying construction-related impacts that are common to all alternatives, the air quality analysis discusses the potential operational effects associated with the various types of solar and wind technologies summarized in **Section 1.12**, Solar and Wind Technologies, and discussed in detail in **Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona, under Overview of Renewable Energy Technologies.

The primary indicators of air quality impacts are the ambient air quality standards documented in **Section 3.2**, Air Quality and Air Quality-related Values, that define ambient air quality, incremental degradation of air quality, and air quality-related values, including visibility. Indicators utilized for this analysis include the following:

- Location of REDAs and the Agua Caliente SEZ in relation to federal nonattainment areas; and
- Location of REDAs and the Agua Caliente SEZ in relation to Class I areas.

The following assumptions were used in the impact analysis:

- The overall development acreages for solar and wind development would be similar under each REDA alternative (the same MWs would be produced) even though the size of the REDA is different.
- Air quality impacts can be localized or regional depending upon the pollutant being analyzed.
- Weather-related events may cause local or regional air quality impacts.
- Design features and BMPs identified in **Appendix B**, Design Features and Best Management Practices, would be implemented

for site-specific projects as applicable to the specific project and site location to minimize construction- and operation-related emissions.

Impacts Common to All Alternatives

There would be no direct air quality impacts from the identification of a REDA. Indirect impacts on air quality associated with renewable energy development include construction-related emissions and, to a lesser extent, operational emissions. Solar development under each alternative would affect approximately 12,000 acres of BLM-administered lands state-wide. Wind development, which requires much less surface disturbance than solar, would disturb approximately 3,600 acres of BLM-administered lands state-wide. Emissions from individual renewable energy projects would be dispersed across the planning area and could occur throughout the planning timeframe. These projects would have short-term and long-term localized impacts at the project sites but would not contribute to regional degradation of air quality over the long term, as explained below.

Impacts associated with constructing and operating solar and wind facilities, including access roads and transmission lines, would vary greatly depending on the type of technology and the location and scale of the project, and potential impacts would be assessed on a site-specific basis during the ROW application process. However, a description of the types of air quality impacts that would be expected from the construction and operation of renewable energy facilities is provided below.

Solar Energy Development. The Draft Solar PEIS (BLM and DOE 2010) provides a thorough characterization of the types of air emission sources that are associated with each phase of solar facility development, including site characterization, construction, decommissioning/reclamation, and roads and transmission lines, as well as the types of air pollutants emitted (see BLM and DOE 2010, p. 5-145 to 5-149, for a detailed discussion of solar development-related impacts). As described in the Draft Solar PEIS, site characterization generally has negligible emissions except where deep soil coring is required to obtain geotechnical data, well drilling is required for groundwater characterization, or access roads must be developed to reach the site. In these cases, surface clearing would produce fugitive dust emissions, and coring and drilling equipment and heavy road equipment would produce criteria air pollutant emissions and small amounts of toxic air emissions associated with vehicle and equipment combustion processes.

Construction of a solar facility includes a number of operations, with most air quality impacts occurring during site preparation (clearing, grading, and cut and fill if needed to produce acceptable slopes) and facility construction. Depending on the size of the facility, construction would occur over months or years. For large facilities, construction activities would be staggered, such that different

activities would occur on different areas of the project site over the period of construction. As described in the Draft Solar PEIS (BLM and DOE 2010, p. 5-145), major equipment used during site preparation would include chain saws, chippers, dozers, scrapers, end loaders, trucks, cranes, rock drills, and blasting equipment if required. Major equipment used in the construction phase would include cranes, end loaders, backhoes, dozers, trucks, and a concrete batch plant if required.

The primary pollutants emitted during construction are fugitive dust (associated with site preparation, transmission line and road development, and vehicle and equipment use on unpaved surfaces) and exhaust emissions (associated with major equipment usage, construction worker commute traffic, and truck deliveries to the project site).

As described in detail in the Draft Solar PEIS (BLM and DOE 2010, p. 5-146), solar development has the potential to release large amounts of fugitive dust. These conditions are dependent upon the amount of surface disturbance, the soil conditions of the project site, and meteorological (wind) conditions. Under high-wind conditions in areas with highly erodible soils, fugitive dust could exceed ambient air quality standards at project site boundaries, causing short-term, localized, unavoidable impacts. Fugitive dust would have the greatest potential for impact in PM_{10} nonattainment or maintenance areas or at project sites that occur near sensitive receptors such as residences, schools, or Class I areas. It should be noted that most REDAs are not located in nonattainment areas, and most are in more remote areas where construction would be unlikely to affect residences or schools. REDAs are located within 62 miles of Class I areas, primarily southwest of Grand Canyon National Park and east and west of Petrified Forest National Park.

Fugitive dust impacts associated with site-specific actions on BLM-administered lands would be addressed during the ROW application process through the requirement of a Dust Abatement Plan and implementation of design measures and BMPs such as those contained in **Appendix B**, Design Features and Best Management Practices. These measures could include minimizing the amount of area disturbed at one time, surfacing roads and parking lots with aggregate, stabilizing disturbed area through watering, minimizing vehicle speeds on unpaved surfaces, and halting construction on windy days. Construction-related fugitive dust impacts would be short term and temporary, lasting until site soils were stabilized upon the completion of facility construction.

In addition to fugitive dust impacts, solar facility construction could result in substantial emissions of criteria air pollutants, volatile organic compounds, greenhouse gases (discussed further in **Section 4.2.2**, Greenhouse Gas Emissions and Climate Change), and small amounts of toxic air pollutants through the combustion of fuel in construction equipment, worker commute vehicles, and truck deliveries. For projects on BLM-administered lands,

emissions would be minimized through design measures and BMPs such as those listed in **Appendix B**, Design Features and Best Management Practices. Emission reduction measures could include measures such as requiring routine preventive maintenance, specifying the use of equipment that meets more stringent emission standards, requiring emission control devices or the use of ultra-low sulfur diesel fuel, and minimizing idling time. The specific measures would be determined during the ROW application process.

Wind Energy Development. The Wind Energy PEIS characterizes the types of air emission sources and air pollutants that are associated with various phases of wind energy development, including site monitoring and testing; site construction; site access, clearing, and grade alterations; foundation excavations and installations; wind turbine erection; and decommissioning (BLM 2005b).

Similar to solar energy development, wind energy development would result in the emissions of fugitive dust from surface disturbance and criteria pollutant, volatile organic compound, greenhouse gas, and hazardous air pollutant emissions associated with construction equipment, worker commute vehicles, and delivery vehicles. Unlike solar development, the primary source of fugitive dust emissions likely would occur during the construction of access roads, which sometimes must be developed through steeper terrain and may include blasting and cut and fill operations. The majority of areas with wind energy potential occur in REDAs that are outside of PM_{10} maintenance and nonattainment areas.

Like solar facility construction, wind energy facility construction could result in substantial emissions of criteria air pollutants, volatile organic compounds, greenhouse gases, and small amounts of toxic air pollutants through the combustion of fuel in construction equipment, worker commute vehicles, and truck deliveries. The greatest source of emissions would be during the development of access roads and during the development of foundations and erection of the wind turbines, which would require substantial use of heavy equipment, the possible use of diesel generators and concrete batch plants, delivery and set up of cranes, and delivery of wind turbine equipment.

Similar to solar energy facility construction, a Dust Abatement Plan and design features and BMPs identified in **Appendix B**, Design Features and Best Management Practices, would be required to minimize air quality impacts resulting from wind energy development on BLM-administered lands. The specific measures deemed necessary to reduce air quality impacts on an acceptable level would be determined during site-specific permitting of individual projects.

Solar Energy Operation. The Draft Solar PEIS describes the air emissions associated with operation of PV and CSP (parabolic trough and power tower) solar facilities (see BLM and DOE 2010, p. 5-147 for a detailed discussion of operational impacts).

PV solar facilities would result in negligible emissions of criteria air pollutants from operation of the solar generating equipment itself. Operation of a PV solar facility would result in minor emissions from personal and maintenance vehicles, limited delivery trucks, and limited equipment exhaust, as well as fugitive dust emissions from windborne dust and dust generated by vehicles on unpaved surfaces. Emergency diesel generators, space heating boilers, and emergency fire-water pump engines, if used, would emit minor amounts of criteria air pollutants and hazardous air pollutants. These sources would likely require stationary air permits from the state; such permits would include operational parameters such as allowable fuel type, required control equipment, and hours of use permitted per year.

CSP facilities would result in similar types of operational emissions as described for PV solar facilities, above. In addition, some CSP technologies (parabolic trough and power tower) would require small-scale boilers and cooling towers, which would emit criteria pollutants and small amounts of toxic air pollutants in the case of boilers and particulates in the case of wet cooling towers (though drift eliminators could be used to minimize particulate emissions from cooling towers).

The amount of air pollutants generated during operation of solar facilities would be much less than the amount emitted during facility construction. Some design measures and BMPs required to minimize construction-related emissions may also be required to minimize operational emissions, particularly fugitive dust, during facility operation.

Wind Energy Operation. Wind energy facilities would have negligible emissions associated with operation of the wind turbines themselves. Operational emissions would include minor levels of criteria pollutants from scheduled changes of lubricating and cooling fluids and greases, limited vehicle use for maintenance activities, and limited equipment exhaust from routine brush clearing.

Decommissioning and reclamation would have impacts similar to those described for construction for both solar and wind facilities, and measures to minimize impacts would likely be similar to those described in **Appendix B**, Design Features and Best Management Practices.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Solar and wind development would occur at its current pace. Projects would have short-term and localized impacts at the project sites during construction. Operational impacts would be much less and would not contribute to regional degradation of air quality over the long term. These impacts are discussed under Impacts Common to All Alternatives, above.

Impacts from Alternative 1

Impacts from Maximum REDA

The nature and type of air quality impacts would be the same as those described above for Impacts Common to All Alternatives. Because this alternative provides the most land area and the most flexibility for siting renewable energy projects, there is the potential for such projects to be dispersed over the widest area. To the extent that this alternative resulted in the need for longer access roads or gen-tie lines, temporary construction-related impacts could be greatest under this alternative. A Dust Abatement Plan described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, and design measures and BMPs described in **Appendix B** would be implemented to minimize impacts on air quality during construction and operation.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts likely to occur from utility-scale solar development within the proposed Agua Caliente SEZ would be similar to those described above for Impacts Common to All Alternatives. Alternative 1 is one of the alternatives that contains the largest SEZ land area and thus could potentially support the largest amount of utility-scale development. If multiple utility-scale projects were proposed and constructed, and particularly if construction periods of different projects overlapped, short-term localized impacts could occur from generation of fugitive dust on project sites and from construction traffic-related exhaust emissions on area roadways. A Dust Abatement Plan described in Chapter 2 and design measures and BMPs described in **Appendix B** would be required to minimize construction-related impacts within the proposed SEZ. The proposed Agua Caliente SEZ is not within 62 miles of any Class I area and is in an area that is in attainment with all of the ambient air quality standards.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of air quality impacts would be the same as those described for Impacts Common to All Alternatives. Because REDAs under this alternative only include lands within five miles of existing or certified transmission lines and utility corridors, the distance to connect the proposed developments to transmission would be minimized, potentially reducing construction-related impacts as compared with the No Action Alternative. Measures to minimize air quality impacts would be the same as described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts likely to occur from utility-scale solar development within the proposed Agua Caliente SEZ would be similar to those described for Impacts Common to All Alternatives. Alternative 2 contains a smaller SEZ footprint compared with Alternative 1 and would likely result in a lesser amount of development within the proposed SEZ. Short-term impacts

related to construction would likely be less than described for Alternative 1. Measures to minimize air quality impacts would be the same as described under Alternative 1.

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and type of air quality impacts would be the same as those described for Impacts Common to All Alternatives. Limiting development to within 10 miles of load centers could encourage development closer to populated areas, resulting in potential localized short-term air quality impacts on sensitive receptors if such receptors were located adjacent to construction activities. Measures to minimize air quality impacts would be implemented to reduce emissions and ensure that ambient air quality standards at property boundaries were not exceeded. Development closer to population centers may reduce the miles of dirt access roads required compared with other action alternatives, potentially reducing regional fugitive dust impacts compared with these alternatives. Measures to minimize air quality impacts would be similar to those described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts likely to occur from utility-scale solar development within the Agua Caliente SEZ would be similar to those described for Impacts Common to All Alternatives. Alternative 3 contains the smallest SEZ footprint and would likely result in the least amount of development within the proposed SEZ and thus the lowest air emissions. Measures to minimize air quality impacts would be the same as described under Alternative 1.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The nature and type of air quality impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 4 includes the same land area as Alternative 1 but would limit technologies in water resource protection zones to dry-cooling technology. Prohibiting wet cooling may encourage PV solar over other solar technologies, slightly reducing potential operational-related emissions. Measures to minimize air quality impacts would be the same as described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Air quality impacts would be the same as described under Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

The nature and type of air quality impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 5 would emphasize land exchanges for renewable energy development, resulting in less development on BLM-administered land and more development on non-federal lands. Because projects would be subject to permitting requirements on public or private lands,

this alternative would have impacts similar to the other alternatives. Measures to minimize air quality impacts would be the same as described under Alternative 1.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

The nature and type of air quality impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 6 would place renewable energy development near transmission and load centers while maintaining the water protection zones described for Alternative 3. Impacts would be similar to Alternative 2 in the size of the potential development area, similar to Alternative 3 in the potential effects to sensitive receptors close to load centers, and similar to Alternative 4 in prohibiting wet-cooling technology. Measures to minimize air quality impacts would be the same as described under these alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Air quality impacts would be the same as described under Alternative 2.

4.2.2 Greenhouse Gas Emissions and Climate Change

Evaluation Methodology, Resource Indicators, and Assumptions

The potential effects of renewable energy development were evaluated by assessing the effects that anticipated future actions consistent with the alternatives would have on the production of greenhouse gas emissions. Because wind and solar technologies produce minimal greenhouse gas emissions during operation, the analysis focuses primarily on impacts associated with their development, including construction activities and reclamation/abandonment activities. The analysis discusses short-term increases in greenhouse gas emissions during development versus the long-term effects related to the ability of renewable energy facilities to offset energy needs provided by fossil fuel-burning energy facilities.

The primary indicator of greenhouse gas-related impacts is the potential for the proposed action and alternatives to increase or decrease long-term levels of greenhouse gases and the potential resulting effects on global climate change.

The following assumptions were used in the impact analysis:

- The overall development acreages for solar and wind development would be the same under each alternative.
- The overall amount of energy provided by renewable sources would be the same under each alternative.
- There is believed to be a correlation between levels of greenhouse gases produced and climate change.

- The development of renewable energy facilities would offset energy provided by fossil fuel-burning energy facilities.
- Design features and BMPs identified in **Appendix B** would be implemented for site-specific projects as applicable to the specific project and site location to minimize construction- and operation-related greenhouse gas emissions.

Impacts Common to All Alternatives

Greenhouse gases are gases that contribute to the natural greenhouse effect, including carbon dioxide, methane, nitrous oxide, and water vapor, as well as gases that are manmade, including hydrofluorocarbons, chlorinated fluorocarbons, and sulfurhexafluoride. Greenhouse gases are often reported in units of carbon dioxide equivalents (CO_{2e}).

There would be no direct impacts from the identification of a REDA. Indirect impacts associated with solar and wind energy development would include permanent removal of vegetation, which releases carbon stored (sequestered) in the cleared vegetation, and greenhouse gas emissions resulting from fuel combustion associated with heavy construction equipment and vehicle and truck use. These activities, which are the primary source of greenhouse emissions associated with renewable energy development, would be short term and temporary, lasting only during the construction period. Design measures and BMPs that reduced equipment and vehicle exhaust emissions would also reduce greenhouse gas emissions.

Greenhouse gas emissions associated with operation of solar and wind facilities would be much less than during construction and would result from any fuel-burning equipment needed to maintain or operate the facility, such as boilers or generators, landscaping equipment, and vehicle use, as well as any fossil fuel-generated electricity needed to operate water pumps and lighting, if this energy could not be provided by the renewable energy source itself.

Greenhouse gas emissions associated with decommissioning/reclamation of solar and wind facilities would be similar to, but less than, those associated with construction. Design measures and BMPs that reduced equipment and vehicle exhaust emissions associated with decommissioning/reclamation would also reduce greenhouse gas emissions.

In addition to the direct greenhouse gas emissions from project construction, operation, and decommissioning/reclamation, indirect greenhouse gas emissions would be associated with the production and shipment of equipment used on the site and the reduced sequestration capacity if removed vegetation is not replaced.

Because solar and wind facilities operate for decades with minimal production of greenhouse gases, the potential greenhouse gas savings in the form of offsetting

energy produced by fossil fuel sources outweighs life-cycle emissions of greenhouse gases. Arizona receives approximately 68 percent of its power from fossil fuel plants (coal, gas, and oil), 25 percent from nuclear power plants, 6.48 percent from hydroelectric sources, and 0.07 percent from non-hydroelectric renewable sources. Increasing renewable energy output to 15 percent of the state's energy needs by 2025 would result in a substantial reduction in greenhouse gas emissions if a fossil fuel power plant would otherwise be in operation to supply the same amount of power. In Arizona, an estimated 1,700 pounds of CO_2 would be displaced annually per MW-hour of renewable energy produced (EPA 2007).

The EPA's Mandatory Greenhouse Gases Reporting Rule (74 Federal Register 56260, October 20, 2009) mandates the reporting of annual greenhouse gas emissions for certain sources as well as for facilities that emit more than 25,000 metric tons of CO_{2e} per year. Solar and wind energy facilities would likely have annual operating emissions well below this level and would not be subject to this rule.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis, and development would occur at its current pace. Short-term emissions, operational emissions, and life-cycle emissions of greenhouse gases from approved facilities would be similar to those described under Impacts Common to All Alternatives. Development of renewable energy facilities would result in potential greenhouse gas savings over the life of the facilities to the extent that these facilities offset energy produced by fossil fuel sources.

Impacts from Alternatives 1 through 6

Impacts from REDAs

Impacts under Alternatives 1 through 6 would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts from the proposed Agua Caliente SEZ would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred.

4.2.3 Cultural Resources

Evaluation Methodology, Resource Indicators, and Assumptions

Chapter 3, **Section 3.4**, Cultural Resources, provides estimates that field inventories of new project areas would be expected to encounter a range of 2 to 10 archaeological sites per square mile (640 acres), based on local conditions and environmental contexts. Many of these sites could be evaluated as eligible for nomination to the NRHP. Specific project proposals would be reviewed in

compliance with the requirements of NHPA Section 106, including identification and evaluation of affected resources; consultations with the SHPO, Indian tribes, and the public; and cooperative efforts with these participants and the project applicant to avoid, mitigate, or otherwise resolve any adverse effects. Such consultations would be initiated early in the NEPA process and could address the siting and design of proposed projects.

Additionally, in assessing potential impacts within the REDA alternatives, the degree of potential impacts is contingent on a number of conditions, including:

- Prehistoric and historic land use patterns within the proposed REDA;
- The nature and eligibility status of previously recorded cultural resources within the proposed REDA;
- The presence of TCPs or other places of traditional cultural or religious importance within or near the REDA; and
- The location of development within the proposed REDA.

The primary concerns regarding impacts on cultural resources are the loss of physical integrity or the diminishment of the informational, historical, cultural, or other values that make them eligible for the NRHP or that are the basis for scientific research, traditional cultural use, or public education. Two major types of impacts from renewable energy development could adversely affect cultural resources:

- Direct or indirect physical impacts from ground disturbance during construction, operation, or reclamation; and
- Visual or auditory impacts on the setting of a resource, where integrity of setting is integral to its NRHP eligibility or use allocation.

Indirect adverse impacts are also a concern. For example, buried cultural resources may be subject to damage or destruction by erosion that is accelerated by construction disturbance. Moreover, improved access as a result of construction could lead to unauthorized collection or vandalism, depending on the proximity and visibility of archaeological sites.

Two general assumptions can be made regarding cultural resource density in Arizona:

- Human settlement tends to aggregate near reliable water resources; therefore, it can be assumed that cultural resource density increases in proximity to water. Any construction projects undertaken within the proposed REDAs that occur near major or

seasonal drainages, springs, or playa zones would increase the potential for impacts on prehistoric or historic cultural resources.

- Urban areas have a high potential for architecturally significant cultural resources such as NHRP-listed buildings, structures, and neighborhoods. This circumstance is particularly relevant for the Phoenix Basin/Middle Gila and Tucson/Santa Cruz cultural regions, which have large numbers of historic properties; however, smaller municipalities, such as Wickenburg and Winslow, also exhibit a significant number of historic buildings and districts in their respective downtown areas. Therefore, it can be assumed that any construction projects undertaken within the proposed REDAs that occur near urban areas, including nominated sites described in **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites, have a greater potential for impacts, particularly visual impacts, to NRHP-listed properties, as well as to previously unidentified historic resources.

Impacts Common to All Alternatives

- Significant cultural resources, including historic properties listed or eligible for listing on the NRHP, could be affected by renewable energy development regardless of the technology employed. The potential for impacts on cultural resources from renewable energy development, including ancillary facilities such as access roads and transmission lines, is directly related to the amount of land disturbance and the location of a project. Indirect effects, such as impacts resulting from the erosion of disturbed land surfaces, increased accessibility to possible site locations, and visual, auditory, and atmospheric intrusions, are also considered. Potential types of impacts on cultural resources include:

- Complete destruction could result from the clearing, grading, and excavation of a project area and from construction of facilities and associated infrastructure if archaeological sites, historic structures, or traditional cultural properties are located within the project's footprint.

- Degradation and/or destruction of historic properties could result from the alteration of topography, alteration of hydrologic patterns, removal of soils, erosion of soils, runoff into and sedimentation of adjacent areas, and oil or other contaminant spills if sites are located on or near a project area. Such degradation could occur both within a project footprint and in areas downslope or downstream. While soil erosion could affect locations downstream of a project area by potentially eroding materials and portions of downstream archaeological sites, the accumulation of sediment could serve to protect some downstream sites by increasing the amount of protective cover. Erosion can also

destabilize historic structures. Agents of erosion and sedimentation include wind, water, downslope movements, and human and wildlife activities. Contaminants could affect the ability to conduct an analysis of material present at the site and thus the ability to interpret site components.

- Increases in human access and subsequent disturbance (e.g., looting, vandalism, trampling) of cultural resources could result from the establishment of corridors or facilities in otherwise inaccessible areas. Increased human access (including OHV use) may expose resources to greater probability of impact from a variety of stressors, depending on their accessibility and visibility. Standing structures, or other conspicuous site types such as petroglyphs, would be especially vulnerable.
- Visual intrusion into settings associated with significant cultural resources could result from the presence of a renewable energy development and associated land disturbances and ancillary facilities. This could affect properties for which visual integrity is a component of significance, such as TCPs, sacred sites, historic structures developed as interpretive sites, National Historic Trails, and historic landscapes.

Cultural resources are nonrenewable and, once damaged or destroyed, are not recoverable. Though aspects of setting could be restored through closure and reclamation of a facility, in general, if a cultural resource is damaged or destroyed during solar or wind energy development, this particular cultural location, resource, or object would be irretrievable.

Implementing mitigation measures could reduce or minimize adverse impacts on cultural resources. Avoidance is the preferred approach, by which projects would be sited or designed to exclude resources and to prevent damage to them. For cultural resources that are significant for their informational value, scientific data recovery is one way in which some information can be salvaged should a cultural resource site be adversely affected by development activity. Data-recovery procedures could involve excavations, mapping, artifacts and other material collection, geomorphological studies, archival research, or oral histories. Final reports would be required to document the results of fieldwork and analysis, with collections and data preserved for long-term research and public benefit in a museum or other approved facility. Indian tribes would be consulted in developing related research designs, plans, and procedures. Federal agencies would comply with the provisions of the Native American Graves Protection and Repatriation Act to address any discoveries of human remains and associated items protected under that law.

Other mitigation measures include implementing discovery plans to address any unexpected finds during construction, implementing monitoring plans to protect

avoided sites during construction and through the life of a project, and requiring education of workers to ensure that they understand and comply with cultural resource protection measures.

Impacts on settings, and the loss of value for education, heritage tourism, or traditional uses, are less easily mitigated and are best addressed through informed project siting. Visual intrusions could be mitigated through measures designed to reduce visual impacts by lowering the contrast of facilities with the surrounding terrain and viewshed. It may not be possible to mitigate all impacts of a proposed project. Creative or compensatory mitigation measures could be considered; these could involve such approaches as support for related archaeological or ethnographic studies, or associated public-education efforts such as publications or websites featuring project-related studies.

The technology-specific factor that could have a possible impact on the cultural resources assessment is the difference in land requirements of the various renewable energy technologies. Differences in land requirements, however, would not directly correspond to differences in impacts on cultural resources at the programmatic level (e.g., more land equates to greater magnitude of the impact). The magnitude or level of impact would depend on whether the specific location of a proposed solar or wind facility contains significant cultural resources, regardless of the overall size of the facility.

Areas available for solar or wind development are flat valley floors, and aside from trails or other linear features that might cross these valleys, the areas of potential cultural significance, whether prehistoric or historic, would most likely be near dry lake beds, in dune areas, or along washes. Those technologies that can be adjusted to avoid these areas with a higher likelihood to contain sites are less likely to result in impacts on historic properties. For example, dish engine technology is less position-driven with respect to individual units than some of the other linear technologies or the power tower (BLM and DOE 2010).

The different technologies also result in different viewsheds based on facility height differences. For cultural resources with a visual component, such as a historic trail or tribal sacred area, where integrity of setting is an important aspect of the resource's significance, technology choice could be a factor in determining whether a resource is adversely affected.

Differences in water requirements (e.g., water use and discharge) among the technologies are not likely to be a factor in determining levels of impact of surface runoff and possible effects on cultural resources. However, depending on the water source for solar technologies using cooling towers or steam generators, drawdown of surface water levels could increase the potential for erosion in some localities and could inadvertently expose cultural resources present along stream banks or lakeshores. These issues would be addressed at the site-specific level of analysis.

Impacts from the No Action Alternative

Under the No Action Alternative, renewable energy projects would be developed on a case-by-case basis through ROW authorizations in accordance with the BLM's existing land use plans. Therefore, the types of impacts on cultural resources described in Impacts Common to All Alternatives would still occur as renewable energy projects are developed on BLM-administered lands that allow development. The No Action Alternative does not include the additional design features or BMPs described in **Appendix B**, Design Features and Best Management Practices, that would give consistent, state-wide guidance for mitigating impacts; mitigation would be determined project by project and as needed based on the impact analysis for a specific proposal.

Impacts from Alternative 1

Impacts from Maximum REDA

Under Alternative 1, renewable energy development could occur in any area of the REDA. Areas with known sensitive cultural resources that are eliminated from the REDA include BLM ACECs, national monuments, national historic trails (0.25-mile buffer), and specific areas identified by agencies or the public as containing sensitive resources, such as the Gila River Terraces area west of Phoenix. Designated wilderness areas, lands with wilderness characteristics, and critical habitat areas are also eliminated and generally tend to contain sensitive cultural resources. An effort has been made to define REDA in areas of low resource sensitivity. However, as archaeological surveys have covered less than 10 percent of the state, and tribal consultations would be needed to identify important cultural resources, new inventories and consultations would be required to identify and evaluate the impacts of a proposed project in any specific REDA location.

Impacts on cultural resources of the types of impacts described in Impacts Common to All Alternatives would likely result from any ground-disturbing activities associated with the development of renewable energy projects. The likelihood that the selected acreage would contain cultural resources would be assessed by a Class I records search for previously recorded sites, and may entail conducting an intensive Class III survey in areas where existing information remains limited. Using the predictive equation, which estimates 1 cultural resource site per 59.5 acres, there is the potential that approximately 5,403 sites could occur within the 321,500 acres of BLM-administered lands of this alternative. However, as explained in Chapter 3, **Section 3.4.1**, Cultural Resources, RDEP Affected Environment, it is reasonable to expect lower site densities in many proposed REDAs.

Based on spatial data obtained from the NPS, 527 NRHP-listed properties have been identified inside or within 5 miles of Alternative 1, of which approximately 96 percent are architecturally significant historic buildings, structures, and districts. Because historic integrity is directly associated with aspects such as setting and location, these property types would be sensitive to visual and/or

atmospheric impacts. However, many of these NRHP-listed properties represent historic buildings and neighborhoods in the middle of cities and towns far from the REDAs. As such, it is unlikely that these properties would be affected by development within the REDAs.

Applying the proposed design features and BMPs in **Appendix B** would reduce or eliminate (if avoidance is determined the appropriate mitigation based on site-specific analysis) the noted potential impacts on cultural resources. For subsurface sites discovered accidentally during earth-moving activities, the requirements for data collection would salvage important scientific data for future use.

Impacts from Proposed Agua Caliente Solar Energy Zone
Based on known information about historic and prehistoric use in the area of the proposed SEZ (World War II training ranges and prehistoric trails; see **Section 3.4**, Cultural Resources), renewable energy development has the potential to physically impact prehistoric and historic military-related cultural resources, as described in Impacts Common to All Alternatives. In addition, there could be impacts on views from the Juan Bautista de Anza National Historic Trail and the Sears Point ACEC.

Application of the proposed design features and BMPs in **Appendix B** would reduce or eliminate (if avoidance is determine the appropriate mitigation) the noted potential impacts on cultural resources. For subsurface sites discovered accidentally during earth-moving activities, the requirements for data collection would salvage important scientific data for future use.

Impacts from Alternative 2
Impacts from Transmission Line and Utility Corridor REDA
Under Alternative 2, renewable energy development would occur only in a subset of the maximum REDA (Alternative 1), reducing the potential area available for development of renewable energy projects, which in turn reduces the potential for impacting cultural resources in the manner described in Impacts Common to All Alternatives. By using the predictive equation, there is the potential that 3,673 sites could occur within the 218,600 acres of BLM-administered lands in Alternative 2.

A total of 481 NRHP-listed properties have been identified inside or within 5 miles of the Alternative 2 REDA, of which approximately 96 percent are architecturally significant historic buildings, structures, and districts (see **Section 3.4**, Cultural Resources). Like Alternative 1, the historic integrity with aspects such as setting and location would be more sensitive to visual impacts. However, many of these NRHP-listed properties represent historic buildings and neighborhoods in the middle of cities and towns far from the REDA. As such, it is unlikely that that these properties would be affected by development within the REDA.

Like Alternative 1, the proposed design features and BMPs in **Appendix B** would help mitigate the impacts from renewable energy development and would reduce or eliminate the severity of the impacts on cultural resource values.

Impacts from Proposed Agua Caliente Solar Energy Zone
Based on known information about historic and prehistoric use in the area of the proposed SEZ (**Section 3.4**, Cultural Resources), renewable energy development could impact prehistoric and historic resources. The reduction in size of the SEZ, from 20,600 acres to 6,770 acres, would reduce the potential for impacts by eliminating the more-remote areas near mountains and major washes that could contain undisturbed archaeological sites. In addition, there could be impacts on views from the Juan Bautista de Anza National Historic Trail and the Sears Point ACEC.

Any future renewable energy development activities within these portions of the proposed SEZ under Alternative 2 would have the same types of impacts described in Alternative 1 and Impacts Common to All Alternatives. Applying the proposed design features and BMPs described in **Appendix B** would mitigate the impacts in the same manner as described in Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
Under Alternative 3, renewable energy development would occur only in a subset of the Alternative 1 maximum REDA, reducing the potential area available for development of renewable energy projects, which in turn reduces the potential for impacting cultural resources in the manner described in Impacts Common to All Alternatives. By using the predictive equation, there is the potential that 2,182 sites could occur within the 129,800 acres of BLM-administered lands of Alternative 3.

A total of 490 NRHP-listed properties have been identified inside and within 5 miles of Alternative 3 REDA, of which approximately 96 percent are architecturally significant historic buildings, structures, and districts (**Section 3.4**, Cultural Resources). However, many of these NRHP-listed properties represent historic buildings and neighborhoods in the middle of cities and towns far from the REDAs. As such, it is unlikely that that these properties would be affected by development within the REDAs.

Like Alternative 1, the proposed design features and BMPs in **Appendix B** would help mitigate the impacts from renewable energy development and would reduce or eliminate the severity of the impacts by preserving important scientific information.

Impacts from Proposed Agua Caliente Solar Energy Zone
Based on known information about historic and prehistoric use in the area of the proposed SEZ (**Section 3.4**, Cultural Resources), renewable energy development could impact cultural resources. New facilities could introduce

visual impacts on the former White Wing Ranch, a potentially eligible historic resource. However, the large Agua Caliente Solar Project is being constructed on private land encompassing much of the ranch. The reduction in size of the SEZ to 2,760 acres would reduce the potential for impacts by eliminating areas away from modern development that could contain undisturbed archaeological sites. There could be impacts on views from the Juan Bautista de Anza National Historic Trail and the Sears Point ACEC.

Any future renewable energy development activities within the proposed SEZ under Alternative 3 would have the same types of impacts described in Alternative 1 and Impacts Common to All Alternatives. Applying the proposed design features and BMPs would mitigate the impacts in the same manner as described in Alternative 1.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Under Alternative 4, renewable energy development would occur within the Alternative 1 maximum REDA, with the difference that the 321,500 acres on BLM-administered lands would be divided into three water management zones with increasing levels of stringent design features for protecting water resources. Impacts on cultural resources would be similar to those described for Alternative 1.

A total of 527 NRHP-listed properties have been identified inside or within 5 miles of Alternative 4 REDA, of which approximately 96 percent are architecturally significant historic buildings, structures, and districts (**Section 3.4**, Cultural Resources). However, many of these NRHP-listed properties represent historic buildings and neighborhoods in the middle of cities and towns far from the REDAs. As such, it is unlikely that that these properties would be affected by development within the REDAs.

Like Alternative 1, the proposed design features and BMPs in **Appendix B** would mitigate the impacts from renewable energy development and would reduce or eliminate the severity of impacts by preserving important scientific information. Alternative 4 has the additional design features developed for the WPZs; applying these design features would likely reduce erosion in some localities, thereby reducing the possibility of inadvertently exposing cultural resources along stream banks, lakeshores, or other areas vulnerable to erosion.

Impacts from Proposed Agua Caliente Solar Energy Zone

Based on known information about historic and prehistoric use in the area of the proposed SEZ (**Section 3.4**, Cultural Resources), renewable energy development could impact cultural resources. The impacts would be similar to those of Alternative 1 with an SEZ size of 20,600 acres. There could be impacts on views from the Juan Bautista de Anza National Historic Trail and the Sears Point ACEC.

Any future renewable energy development activities within the proposed SEZ under Alternative 4 would have the same types of impacts described in Impacts Common to All Alternatives and Alternative 1. Applying the proposed design features and BMPs in **Appendix B** would mitigate the impacts in the same manner as described in Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Under Alternative 5, renewable energy development would occur only in a subset of the Alternative 1 maximum REDA, reducing the potential area available for development of renewable energy projects, which in turn reduces the potential for impacting cultural resources in the manner described in the Impacts Common to All Alternatives. By using the predictive equation, there is the potential that 734 sites could occur within the 43,700 acres of BLM-administered lands of Alternative 5.

Six NRHP-listed properties have been identified inside or within five miles of Alternative 5, consisting primarily of historic buildings and structures. However, most of these NRHP listed properties represent historic buildings and neighborhoods in cities and towns far from the REDAs. As such, it is unlikely that that these properties would be affected by development within the REDAs.

Like Alternative 1, the proposed design features and BMPs in **Appendix B** would help mitigate the impacts from renewable energy development and would reduce or eliminate the severity of impacts by preserving important scientific information.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Under Alternative 6, renewable energy development would occur only in a subset of the Alternative 1 maximum REDA, reducing the potential area available for development of renewable energy projects, which in turn reduces the potential for impacting cultural resources in the manner described in Impacts Common to All Alternatives. Using the predictive equation, there is the potential that 3,985 sites could occur within the 237,100 acres of BLM-administered lands of Alternative 6.

A total of 503 NRHP-listed properties have been identified inside or within 5 miles of the Alternative 6 REDA, of which approximately 96 percent are architecturally significant historic buildings, structures, and districts (**Section 3.4**, Cultural Resources). Like Alternative 1, the NRHP-listed properties are dominated by historic buildings and neighborhoods in the middle of cities and towns far from the REDAs. As such, it is unlikely that that these properties would be affected by development within the REDAs.

Like Alternative 1, the proposed design features and BMPs in **Appendix B** would mitigate the impacts from renewable energy development. Like

Alternative 4, this alternative has the additional design features prescribed for the WPZs. Applying these design features would likely reduce erosion in some localities, thereby reducing the possibility for inadvertently exposing cultural resources along stream banks or other zones vulnerable to erosion.

Impacts from Proposed Agua Caliente Solar Energy Zone
Based on known information about historic and prehistoric use in the area of the proposed SEZ (**Section 3.4**, Cultural Resources), renewable energy development could impact cultural resources. The impacts would be similar to those of Alternative 2, as the SEZ would include 6,770 acres. There could be impacts on views from the Juan Bautista de Anza National Historic Trail and the Sears Point ACEC.

Any future renewable energy development activities within these portions of the proposed SEZ under Alternative 6 would have the same types of impacts described in Impacts Common to All Alternatives and Alternative 1. Applying the proposed design features, including the water resource protection design features noted as part of this alternative and BMPs, would mitigate the impacts in the same manner as described in Alternative 4.

4.2.4 Energy and Minerals

Evaluation Methodology, Resource Indicators, and Assumptions
This section discusses impacts on leasable, locatable, and saleable minerals from proposed management actions described in **Chapter 2**, Description of Alternatives and Reasonably Foreseeable Development Scenario. There would be no direct impacts on energy and mineral resources from the identification of a REDA. The potential indirect effects of the alternatives were evaluated by assessing the impacts that anticipated future actions described in Chapter 2 would have on energy and mineral resources. Existing conditions of energy and mineral resources are described in **Chapter 3**, Affected Environment.

Leasable minerals in the planning area include oil and gas, geothermal, and potash. Locatable minerals include such commodities as copper, gold, manganese, tungsten, silver, and uranium. Salable minerals, also referred to as material minerals, include such commodities as sand and gravel, common varieties of building stone, cinders (clinker), common varieties of clay, decorative rock, and petrified wood.

Indicators for impacts on energy and mineral resources include the following:

- The amount of land made unavailable for mineral resource activities; and
- The restrictions that may be placed on mineral claiming, leasing, or development activities.

Potential impacts on energy and mineral resources could occur if reasonably foreseeable future actions were to result in the following:

- A reduction in federal leasing and development of oil and gas or potash;
- A reduction in exploration for or development of locatable or salable minerals; or
- The construction of transmission lines that would affect the feasibility of other energy development along the transmission corridor.

In areas that are open to mineral development, factors that affect mineral extraction and prospecting include, but are not limited to, permitting, regulatory policy, public perception and concerns, travel management, transportation, proximity to sensitive areas, low commodity prices, taxes, and housing and other necessities for workers.

Due to the inability to predict future solar and wind energy development scenarios, including types of development, timing, and location, the following impact analysis provides a general description of impacts on energy and mineral resources from renewable energy development within the REDA and solar development within the proposed SEZ. The analysis includes the following assumptions:

- Existing leases and claims would not be affected by identifying lands as the REDA or the proposed SEZ.
- Arizona's renewable energy goal will increase solar and wind energy development in the state.
- As the demand for energy increases, so will the demand for energy resources.

Impacts from the No Action Alternative

Leasable Minerals

Under the No Action Alternative, solar and wind energy development would continue to be permitted on a case-by-case basis. If solar or wind energy facilities are constructed, future leasable mineral activities would be precluded since most solar and wind facilities are incompatible with mineral leasing development activities. An exception to this could occur if the leasable mineral could be accessed under a solar or wind energy facility utilizing offset drilling technologies. Since there has been no oil and gas or geothermal production in the planning area, the impact on leasable minerals from solar and wind energy development is expected to be negligible.

Locatable Minerals

Mineral exploration and development of locatable minerals is allowed under the General Mining Law of 1872 on all BLM-administered lands unless it is withdrawn from mineral entry. Under the No Action Alternative, areas designated as open to locatable minerals could remain open to the location of mining claims. Existing valid mining claims would preclude solar or wind energy development. However, construction of solar or wind energy facilities and transmission lines would establish a superior right over subsequent mining claim location. As such, impacts on exploration and development could occur in areas of high potential for locatable minerals.

Salable Minerals

Mining mineral material predominately involves surface mining methods. Under this alternative, salable mineral development activities could continue in areas open to salable mineral development where surface-disturbing activities are permitted. In areas with no mining activities, solar and wind energy development would preclude future mining activities in those areas. However, the expected impact on salable minerals from solar and wind energy development is expected to be negligible because salable minerals are abundant and widespread in the planning area.

Impacts Common to All Action Alternatives – REDAs

Leasable Minerals

As noted in **Section 3.5**, Energy and Minerals, there are minimal oil and gas and geothermal resources within the REDA; if oil and gas or geothermal resources are discovered in the REDA, these resources could potentially be accessed using directional drilling methods, whereby the resource is accessed from outside the boundary of the project. Impacts on oil, gas, and geothermal resources from solar and wind energy development are therefore expected to be negligible.

The Holbrook Basin potash potential area has been identified as an "Area with Known Sensitive Resources" (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]). As such, these lands have been eliminated from consideration as REDAs, and the impact on potash development would be negligible.

Locatable Minerals

As stated above, mineral exploration and development of locatable minerals is allowed under the General Mining Law of 1872 on all BLM-administered lands unless it is withdrawn from mineral entry. Under all action alternatives, metallic mineral districts and areas with high potential of known mineral deposits have been identified as "Areas with Known Sensitive Resources" (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]) and eliminated from consideration as REDAs. Eliminating metallic mineral districts and areas with high potential of known mineral

deposits from consideration reduces impacts on locatable minerals from solar and wind energy development.

The total acreage of BLM-administered lands with existing mining claims cannot be determined at this time. However, prior to authorizing new solar or wind energy developments, BLM would investigate and identify the location of existing valid mining claims within the proposed project area. Where valid mining claims overlay the REDA, the BLM Authorized Officer would determine if it is possible to locate solar and wind energy facilities in or close to these areas in such a way as to avoid future adverse effects on mineral development activities. If mining claims are not present, solar and wind energy development (including authorized ROWs) could result in constraints on new mineral development activities if newly proposed activities are not compatible with existing uses.

Salable Minerals

Under all action alternatives, solar and wind energy development would preclude future salable mining activities in those areas. This would result in a localized impact on salable mineral development if these resources become sought after in areas where solar or wind facilities have been constructed and sources are limited. However, there are numerous locations of known occurrences and prospects for salable minerals throughout the planning area, so dispersed impacts on salable mineral development would be negligible.

Impacts Common to All Action Alternatives – SEZ

Impacts described under this section are common to all action alternatives, with the exception of Alternative 5, under which no SEZ would be proposed.

Leasable Minerals

The proposed SEZ is in an area identified as having less than moderate potential area for oil and gas and has no existing leases; oil and gas production in this area is not likely. If oil and gas resources are discovered in the proposed SEZ, these resources could potentially be accessed using directional drilling methods, whereby the resource is accessed from outside the boundary of the no surface occupancy requirement.

Although the proposed SEZ is within the geothermal potential area as identified by the BLM Geothermal Leasing PEIS (BLM 2008b), there are no active geothermal leases in the area and no geothermal exploration has occurred. As a result, solar energy development in the proposed SEZ is expected to have a negligible impact on geothermal resources. If geothermal resources are discovered after a solar facility is constructed, geothermal resources could potentially be accessed using directional drilling methods.

Locatable Minerals

Under all action alternatives (except Alternative 5, under which no SEZ would be proposed), BLM-administered lands identified as the proposed SEZ would be

recommended for withdrawal from the location of mining claims. Withdrawal or closure of an area to location of mining development removes the mineral resources in that area from being able to be accessed and extracted. The proposed SEZ does not have a high potential for mineral occurrence, nor are there active mining claims or active mines in the area. As a result, withdrawing the proposed SEZ from mineral entry would result in a direct but negligible impact on locatable minerals.

Salable Minerals

The proposed SEZ has moderate potential for salable minerals, including sand, gravel, aggregate, cinders, decorative rock, and building stones. Utility-scale solar development projects would be incompatible with salable mineral development, so once these facilities were constructed, the extraction of salable resources in the area would not be possible. This would result in a localized impact on salable mineral development if these resources become sought after in this area. However, there are numerous locations of known occurrences and prospects for salable minerals in and surrounding the proposed SEZ and no existing mines, so dispersed impacts on salable mineral development would be negligible.

Impacts from Alternative 1

Impacts from Maximum REDA

The nature and type of impacts on minerals and energy are described under Impacts Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on minerals are as described in Impacts Common to All Action Alternatives – SEZ, above. Under Alternative 1, the proposed 20,600 acres SEZ is larger than the 12,000 acres of BLM-administered lands that are estimated to be developed for renewable energy projects across Arizona by 2025. Installation of solar facilities on 80 percent of these lands at a generation rate of 8 acres per MW would result in a generation capacity of 2.1 GW on 16,480 acres.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of impacts on minerals and energy are described under Impacts Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on minerals are as described in Impacts Common to All Action Alternatives – SEZ, above. Under Alternative 2, the proposed 6,770-acre SEZ represents more than half than the 12,000 acres of BLM-administered lands that are estimated to be developed for renewable energy projects across Arizona by 2025. Development of the proposed SEZ for solar energy would be a major contribution to the portion of Arizona's renewable energy portfolio that would occur on BLM-administered lands. Installation of solar facilities on 80 percent of

these lands at a generation rate of 8 acres per MW would result in a generation capacity of 680 MW on 5,400 acres.

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and type of impacts on minerals and energy are described under Impacts Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on minerals are as described in Impacts Common to All Action Alternatives – SEZ, above. Under Alternative 3, the proposed 2,760-acre SEZ represents approximately one quarter of the 12,000 acres of BLM-administered lands that are estimated to be developed for renewable energy projects across Arizona by 2025. Development of the proposed SEZ for solar energy would be a substantial contribution to the portion of Arizona's renewable energy portfolio that would occur on BLM-administered lands. Installation of solar facilities on 80 percent of these lands at a generation rate of 8 acres per MW would result in a generation capacity of 275 MW on 2,200 acres.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The nature and type of impact on minerals and energy is described under Impacts Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Same as described in Impacts Common to All Action Alternatives – SEZ, above.

Impacts from Alternative 5

Impacts from Land Tenure REDA

The nature and type of impact on minerals and energy is described under Impacts Common to All Action Alternatives.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

The nature and type of impacts on minerals and energy is described under Impacts Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on minerals are as described in Impacts Common to All Action Alternatives – SEZ, above. Impacts on renewable energy from the proposed SEZ under Alternative 6 would be the same as described above for Alternative 2.

4.2.5 Environmental Justice

Evaluation Methodology, Resource Indicators, and Assumptions

On February 11, 1994, Executive Order 12898 (Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations) was

published in the Federal Register (59 Federal Register 7629). The order requires each federal agency to recognize and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. The EPA has defined environmental justice as the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

As described in **Section 4.2.16**, Socioeconomics, counties within the planning area were examined for minority or low-income populations based on CEQ guidelines (20 percentage points higher than the national average or more, or 50 percent of the total population).

All socioeconomic impacts analysis was conducted using the largest proposed SEZ footprint. U.S. census tracts within a 25-mile radius of the proposed Agua Caliente SEZ were examined to identify any minority or low-income populations based on CEQ guidelines.

Potential impacts on environmental justice could occur if anticipated future actions described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, were found to:

- Result in actions that could lead to a potential reduced income/employment to these communities;
- Result in actions that could lead to an impediment to economic development in low-income or minority communities; or
- Result in actions that could lead to disproportionate potential for human health and safety impacts on low-income or minority communities.

Assumptions for the impact analysis of environmental justice are the same as those provided for **Section 4.2.16**, Socioeconomics.

Impacts Common to All Alternatives

Arizona, as a whole, is not a minority or low-income population compared with national averages. Four counties within the planning area meet CEQ guidelines as minority populations (Apache, Navajo, Santa Cruz, and Yuma Counties) (**Section 3.16**, Socioeconomics and Environmental Justice). It should be noted that the populations in Apache and Navajo Counties are predominantly American Indian. The planning area excludes tribal lands; therefore, impacts on these populations would likely be minimized. Some tribal lands are located adjacent to REDAs, and impacts on these populations would be analyzed prior to site-specific development, as appropriate. Santa Cruz and Yuma Counties have large Hispanic populations; should project actions result in disproportionate effects on these populations, impacts on environmental justice

populations could occur. No low-income populations were identified in the planning area, according to CEQ guidelines (**Section 3.16**, Socioeconomics and Environmental Justice).

Actions that may affect low-income or minority populations include, but are not limited to, noise and dust during the construction of renewable energy facilities, operations/maintenance-related noise, fugitive dust, traffic, and changes to public land access; visual changes to the environment; and impacts on the local community economic resources and social structure. Additional discussion of these factors is included in **Section 4.2.16**, Socioeconomics.

Impacts resulting from the construction and operation of facilities with the potential to affect low-income and minority populations are likely to be small due to the absence of a significant population near many sites suitable for development and the short-term nature of many of the construction-related impacts. Location-specific analysis would be conducted prior to project-specific permitting and development, and measures to mitigate any impacts would be undertaken.

For the proposed SEZ, U.S. census tracts in a 25-mile radius were examined for low-income and minority populations. Both Yuma County and two census tracts (Census Tracts 121 in Yuma County and 7233.02 in Maricopa County) were found to have a significant (over 50 percent) minority population predominantly comprised of Hispanic or Latino persons. No low-income populations were identified. Construction- and operations-related actions as describe above may result in impacts on this population.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind development by statute, regulation, or orders would remain excluded, and administratively excluded areas would be assessed based on management in local land use plans. Impacts on environmental justice populations would be assessed on a project-specific level. In the absence of identifying the REDA, solar and wind project development would likely result in patchy, fragmented development. In addition, no standard set of design features or BMPs would be developed.

Impacts from Alternatives 1 through 6

Impacts from Maximum REDA

Impacts would be the same as described under Impacts Common to All Alternatives. Project-related design features and BMPs such as those for public health and safety, visual resources, noise, and air quality would mitigate many of the construction-related impacts (**Appendix B**, Design Features and Best Management Practices). Local community outreach would be undertaken to involve community members near sites of proposed development and gain input on site-specific actions and develop any relevant mitigation measures. Where

such environmental justice impacts were determined to be likely to occur, it is recommended that the developer make a plan to implement a number of mitigation measures to ease the potential environmental, economic, cultural, and health impacts on minority populations (**Appendix B**, Design Features and Best Management Practices).

Impacts from Proposed Agua Caliente Solar Energy Zone
Project actions within the proposed SEZ would be designed with the minority population in mind. Impacts would be similar to those described above. It is recommended that public relations materials be available in Spanish due to the large Hispanic population in the area.

4.2.6 Fish and Wildlife

Evaluation Methodology, Resource Indicators, and Assumptions
This analysis addresses potential impacts on fish and wildlife from implementing the management actions for the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning fish and wildlife are described in **Section 3.6**, Fish and Wildlife. This analysis focuses on solar and wind energy development that has the potential to physically harm, injure, or disturb wildlife, and alter or eliminate suitable habitat in the planning area.

Potential impacts on fish and wildlife would vary widely depending on a variety of factors, such as the size of animal community, population dynamics in a project area and the adjacent areas; season of construction; extent of the disturbance; type of renewable technology developed; rate of vegetative recovery and composition of this vegetative community; soil type, topography, and microhabitat of the developed sites; and animal species that are present.

Because specific development and site-specific information is not available, species-specific information will be analyzed in detail on a project-level basis.

Potential impacts on fish or wildlife could occur if anticipated future actions were to result in the following:

- Disturb, fragment, or eliminate habitats, food supplies, cover, breeding sites, and other habitat components necessary for population maintenance or used by any species to a degree that would lead to substantial population declines.
- Disturb or eliminate seasonally important habitat (e.g., critical for overwintering or successful breeding) to a degree that would lead to substantial population declines.
- Interfere with a species movement pattern to a degree that would lead to substantial population declines.

- Cause impacts specific to aquatic species and their habitats, including the following:
 - Increased sediment loading in waters containing sediment-intolerant fish species, loss of recruitment, stress, habitat alteration, and habitat loss.
 - Changes to habitat that make it nonfunctional for select species or more conducive to competitive species.
 - Reduce or eliminate streamside cover, leading to increased temperatures, stress, reduced productivity, and impacts on food webs.
 - Actions that alter important water quality parameters, including pH, dissolved oxygen, temperature, hardness, alkalinity/salinity, and turbidity.
 - Deplete water supply leading to loss of physical habitat, changes in water quality, sediment accumulation, habitat alteration, loss of habitat complexity, or food source reduction.

This analysis assumes the following:

- Wildlife habitat needs vary substantially by species. It is generally true, however, that healthy and sustainable wildlife populations can be supported where there is a diverse mix of plant communities with multiple seral stages to supply structure, forage, cover, and other specific habitat requirements. Habitat conditions and quality are directly linked to the health, vigor, and cover of vegetative communities, as well as soil conditions and water quality and quantity.
- Impacts on populations that exceed the current carrying capacity that would not reduce those populations below the carrying capacity would not be considered significant.
- Impacts on terrestrial wildlife from displacement depend on the location, extent, timing, or intensity of the disruptive activity. Furthermore, impacts from displacement would be greater for wildlife species that have limited habitat or a low tolerance for disturbance.
- Big game habitat would be managed in coordination with AZGFD management objectives.
- The BLM is responsible for wildlife habitat. Responsibility for animal population management is delegated to the state, specifically the AZGFD. For federally listed species, population-management responsibility falls to USFWS.

Impacts Common to All Alternatives

Wildlife in the project area is described in relation to available habitat (**Section 3.6**, Fish and Wildlife). Impacts on wildlife include the potential for injury or mortality to wildlife due to project activities (e.g., road collisions, collision with wind turbine blades, nesting disruptions resulting in reduced reproduction for a year, etc.). Surface-disturbing activities that alter vegetation characteristics such as the structure, composition, or production of the vegetative community have the potential to affect habitat suitability for wildlife, particularly where the disturbance removes or reduces cover or food resources. Impacts on vegetation are discussed in **Section 4.2.21**, Vegetation.

The degree of impacts on fish and wildlife would be dependent upon the project location, the project size, and the wildlife present on the site. Habitat disturbance would generally be larger for utility-scale solar or wind operations and less for non-utility scale solar or wind, which have smaller footprints. In general, impacts on rare species or on habitats not well represented in the surrounding area would be greater than impacts on abundant species in common habitat types. It should be noted that impacts described for each phase below represent the potential, non-mitigated impacts from utility-scale renewable energy development; impacts of site-specific development are likely to be reduced due to site-specific measures to avoid important habitat and mitigate impacts. Such measures are discussed in further detail by alternative.

Impacts on wildlife from utility-scale solar are described in the Draft Solar PEIS (Section 5.10, Table 5.10-2) and incorporated here by reference (BLM and DOE 2010). Impacts from non-utility-scale solar would be similar but at a smaller magnitude. Impacts on wildlife from wind operations are summarized in the PEIS on Wind Energy Development (BLM 2005b, Section 5.9.3). Impacts are most likely to occur during construction, operations and maintenance, and reclamation and abandonment. Impacts during siting and development are likely to be limited to temporary disturbance from vehicles and workers and would generally be present at a smaller scale than those during other phases of the project. Potential impacts from solar and wind developments by phase of development are summarized below.

Construction. The greatest potential for impacts on many fish and wildlife species is present during the construction phase of development, as this is the phase with the greatest amount of surface-disturbing activities. During construction, sites would be graded and vegetation cleared. There is the potential for animals to be injured, killed, or disturbed during these activities. The greatest risk would be for animals with limited mobility to avoid construction operations (e.g., reptiles, small mammals) or those that use burrows or are ground nesting (e.g., ground squirrels and other burrowing animals). Larger, more mobile fauna and birds would likely temporarily abandon the site by moving into adjacent habitat. The degree of disturbance would depend upon many factors, including the habitat value, seasonality (e.g., less

disturbance to birds outside of the breeding period), and acreage of disturbance. Additional potential for injury or mortality exists due to vehicle collisions along access roads, especially if these roads occur in wildlife concentration areas or travel corridors. ROW and access road development is also likely to increase the amount of human presence in the area, thus decreasing habitat values and increasing the potential for disturbance or removal of wildlife.

In addition to direct injury or mortality, site construction could result in habitat loss and disturbance. The clearing of vegetation in the construction footprint and increased disturbance in adjacent areas as well as transmission line corridors and access roads could lead to fragmentation of otherwise intact habitat and could have impacts if located in important habitat areas such as breeding sites or migration corridors. Habitat fragmentation could cause loss of genetic interchange among populations and thus reduce reproductive fitness. In addition, habitat fragmentation can increase the amount of edge habitat, making some individuals more vulnerable to predation, disease, and human disturbance.

Additional disturbances in habitat could result from construction noise. Principal sources of noise during construction would include vehicle traffic, operation of machinery, and, if necessary, blasting. Sound levels above 90 decibels are likely to adversely affect wildlife (Manci et al. 1988). Excessive noise levels can alter wildlife habitat use and activity patterns.

Aquatic habitats have additional potential impacts. Draining and filling of aquatic habitats within the construction footprint would result in direct loss of habitat. Vehicles or machinery used in aquatic habitats could kill or injure aquatic organisms. Soil erosion and sedimentation in aquatic habitats could occur as a result of surface disturbance during construction. The potential for erosion is related to the amount of surface disturbance, the proximity to aquatic habitats, the characteristics of site area soils, and degree of vegetative cover. The removal of riparian vegetation could potentially affect the temperature regime in aquatic systems by altering the amount of solar radiation that reaches the water surface, having potential impacts on fish and other biota that have narrow temperature ranges. Additional impacts on aquatic habitat include restrictions on stream movement due to culverts or steam crossings.

Additional potential impacts on wildlife during construction include the following:

- Increased presence of noxious weeds. Disturbed areas within and near a project area, including roadsides and transmission line ROWs, could be colonized by invasive plant species, which could exclude the reestablishment of native species for long periods and may have impacts on wildlife habitat;
- Potential for attraction of predators such as ravens that may harm native wildlife as a result of increased trash and perch sites;

- Disturbance due to fugitive dust from machinery and vehicle traffic;
- Exposure to contaminants in terrestrial or aquatic habitat. Wildlife could be exposed to accidental fuel spills or releases of other hazardous materials. Potential impacts on wildlife would vary according to the material spilled, volume of the spill, location of the spill, length and intensity of exposure (i.e., chronic versus acute exposure), and the exposed species;
- Increased potential for fires due to increased human presence and use of machinery. In general, the effects of fire on wildlife would be related to the impacts on vegetation, which, in turn, would affect habitat quality and quantity, including the availability of forage and shelter;
- Disturbance from site lighting; and
- Changes in hydrological dynamics within wetland and riparian areas due to site grading, affecting species dependent on these habitats.

Operations. Site operations and maintenance would have some of the same impacts as discussed for construction. Although disturbance would generally be reduced compared to construction, human presence, traffic on access roads, fugitive dust, site lighting, operational noise from equipment, and erosion and sedimentation would continue to affect animals on and off the site, resulting in avoidance or reduction in use of an area larger than the project footprint.

Throughout the operational period, the site would have reduced plant cover. The entire site for utility-scale soar facilities would generally be fenced. This would represent a direct loss of habitat and productivity on the site, and would create a barrier to most wildlife movements.

Additional disturbances during site operations include the following:

- Increase in perch locations for raptors and ravens, representing a potentially increased predator presence for native wildlife.
- Minor risk of electrocution or collision of avian species from project associated power lines.
- Reflectivity of solar panels may disturb wildlife and cause site avoidance.

Changes in water quantity and quality represent an additional potential impact. If the renewable energy technology used by a particular project requires water for producing steam for driving turbines or for cooling the produced steam during operation, there is a potential for surface or groundwater depletion and associated impacts on aquatic habitats. Reductions in water quantity could reduce base flow and affect wetlands and riparian habitats dependent on those water levels. Similarly, if the cooling water were discharged into existing surface

water, it could raise the temperature of the receiving water beyond the thermal tolerance of resident species.

Impacts unique to wind development include bird and bat collisions with turbines. Avian mortality estimates based on data collected from the various wind energy projects in the United States indicate an average of 2.19 avian fatalities per turbine per year for all species combined, and an average of 0.033 fatalities for raptors per turbine per year (BLM 2011c).

Decommissioning/Reclamation. In general, the impacts on wildlife associated with decommissioning would be short term and similar to those associated with facility construction, including noise, fugitive dust, increased human presence and traffic, and potential for injury or mortality.

During this phase, the site would be regraded, if needed, and revegetated with a seed mix approved by the BLM in attempts to restore the site to pre-disturbance conditions. Other reclamation activities may include re-establishing natural drainage and hydrological processes and limiting human access to the site. Although reclamation efforts may reintroduce native plants, it may take many years for the project site to be fully restored to pre-disturbance conditions.

In addition to the general impacts described above, impacts for select groups of wildlife are described below.

Migratory Birds. During construction, nests could be destroyed and eggs and nestlings could be harmed. In addition, loss of habitat associated with the proposed action would represent a potential long-term loss of breeding and foraging habitat. The possible violation of the MBTA would be avoided if construction were to occur outside of the breeding season. The migratory bird breeding season would vary dependent on site location, but would generally occur between March and August. Regulations and agreements, such as the MOU between the BLM and USFWS described in **Chapter 3**, Affected Environment, would help to reduce the likelihood for impacts by requiring protective measures for migratory birds.

Big Game. Impacts on big game could occur should project development occur in important habitat areas for these species, including but not limited to migration corridors and critical summer or winter habitat. Big game species would be susceptible to impacts described for general wildlife. In particular, fencing and exclusion of habitat would alter wildlife movement as well as behavior important to breeding.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis; impacts on fish and wildlife would be similar in scope and nature to those described under Impacts

Common to All Alternatives, above. Areas eliminated from solar and wind development by statute, regulation, or orders would remain eliminated, and administratively eliminated areas would be assessed based on local land use plans. Impacts on fish and wildlife would be assessed on a project-specific level, and measures to avoid important habitat and mitigate impacts would be undertaken. In the absence of identifying a REDA, however, solar and wind project development would likely result in patchy, fragmented development with an increased likelihood of habitat disturbance and fragmentation of wildlife habitat. In addition, no standard set of design features or BMPs would be developed for protection of fish and wildlife.

Impacts from Alternative 1

Impacts from Maximum REDA

There would be no direct impacts from the identification of a REDA. Indirect impacts on fish and wildlife would result from implementing the planning decisions and possible future ground-disturbing activities associated with construction of renewable energy facilities.

General Fish and Wildlife. Impacts on fish and wildlife would be similar in scope and nature to those described under impacts common to all alternatives above, but would be reduced in scale due to screening and removal of sensitive wildlife areas from consideration; the REDA has been developed to avoid important habitat areas for wildlife to the extent that these areas have been identified and mapped on a state-wide basis. Areas eliminated from the REDA include wildlife corridors identified by the AZGFD, and conservation potential areas ranked 4, 5, and 6 (the three highest conservation potential rankings). Conservation potential categories 1, 2, and 3 have lower conservation value and cover 121,400 acres, 106,700 acres, and 84,100 acres, respectively, on BLM-administered land within the REDA under Alternative 1.

Development of the REDA would reduce disturbance on lands with high wildlife value and encourage renewable energy development on previously disturbed parcels. For new renewable energy actions, BLM Arizona would require submission of proposals for retaining existing infrastructure and rehabilitating, restoring, reclaiming, and remediating the landscape to meet renewable energy design features. As a result, Alternative 1 would result in reduced impacts from disturbance and habitat fragmentation for fish and wildlife.

In addition, project design features and BMPs would require pre-disturbance surveys, as determined appropriate, to identify wildlife that may be present on a project site. Project siting would avoid biologically sensitive locations, including water and riparian habitat and known wildlife corridors. Construction would be timed to avoid, minimize, or mitigate impacts on wildlife. Design features and BMPs would minimize fragmentation, and would be designed to minimize dangers to wildlife from wind turbines, transmission lines, and other site structures, by requiring pre-project evaluation for structure siting, monitoring of

impacts on wildlife during operation, and incorporating best available science related to structure design to minimize impacts on wildlife. Design features and BMPs would also include restrictions on construction equipment and personnel to reduce project noise, vehicular collisions, and waste. Design features and BMPs also provide measures for a qualified biologist to monitor compliance and mitigation measures as well as create a site reclamation plan. Full details are included in **Appendix B**, Design Features and Best Management Practices. Assuming that all appropriate design features and BMPs are followed, impacts on fish and wildlife would be negligible.

Migratory Birds. Project design features and BMPs would limit impacts on migratory birds (**Appendix B**). If project timing was such that construction needed to occur during the breeding season, a pre-construction survey of occupied nests would be conducted, including burrowing and ground nesting species. Any discovered occupied nests would have no-construction buffers around them until such time that either the young have fledged the nests or the nests have been abandoned. In addition, recommendations contained in the Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocol; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance (Pagel et al. 2010) shall be considered in project planning, as appropriate. The "Bald and Golden Eagle Protection Act–Golden Eagle National Environmental Policy Act and Avian Protection Plan Guidance for Renewable Energy" (Instruction Memorandum No. 2010-156) will need to be adhered to. Finally, all gen-tie lines would comply with the Avian Power Line Interaction Committee (2006) recommendations. Therefore, impacts on migratory birds would be negligible.

Big Game. AZGFD big game habitat, including known wildlife corridors, was eliminated from consideration as REDA, therefore impacts on big game should be minimal. While the potential for impacts on individual animals may still be present, population levels should not be impacted.

Impacts from Proposed Agua Caliente Solar Energy Zone

This section addresses wildlife (amphibians, reptiles, birds, and mammals) and aquatic biota that could occur within the potentially affected area of the proposed Agua Caliente SEZ. The affected area considered in this assessment included the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur), as well as the area within one mile of the proposed SEZ boundary where ground-disturbing activities would not occur but could be affected by proposed project activities (e.g., surface runoff, dust, noise, lighting, and accidental spills in the proposed SEZ).

The maximum developed area within the proposed Agua Caliente SEZ under Alternative 1 would be 20,600 acres, and the primary land cover habitat type is Sonora-Mojave Creosotebush-White Bursage Desert Scrub (see **Section 4.2.21**, Vegetation). Wildlife associated with this habitat type is described in

Chapter 3, Affected Environment. Acreages of conservation potential categories are presented in **Table 4-1**, Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative. Most of the area is considered to have low conservation potential. There are no perennial aquatic habitats in the affected area, although six main ephemeral washes run north-south within the proposed SEZ. Three of these washes support riparian habitat, which may serve as wildlife corridors for species such as mule deer and mountain lion. Areas within one mile of the proposed SEZ have similar habitats to those found within the proposed SEZ.

Table 4-1
Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative

Conservation Potential Category	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 6
1	19,690	6,560	2,600	19,690	6,560
2	10	0	0	10	0
3	190	50	50	190	50
4	690	140	110	690	140
5	20	10	0	20	10
6	0	0	0	0	0

Source: AZGFD 2011a; BLM 2011a, 2011b

The types of impacts on wildlife that could occur from construction, operations and maintenance, and reclamation and abandonment of utility-scale solar energy facilities are discussed above under Impacts Common to All Alternatives. The acres of potentially affected habitat are presented in **Section 4.2.21**, Vegetation. Any such impacts would be minimized through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices, and as discussed under Impacts from Alternative 1.

Development of the proposed SEZ would remove and fragment wildlife habitat in the southern portion of the Palomas Plain WHA. As described in **Section 3.6.2**, Fish and Wildlife, Agua Caliente SEZ Affected Environment, this area is the largest unfragmented habitat remaining in southwest Arizona for bighorn sheep and mule deer. As such, effects from habitat loss and fragmentation could occur, such as those described above for general wildlife. Impacts would be reduced through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Impacts for Alternative 2 would be similar to those described for Alternative 1. Conservation potential categories 1, 2, and 3 cover 96,800 acres, 90,400 acres

and 21,100 acres, respectively, of BLM-administered land within the REDA under Alternative 2.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on fish and wildlife would be similar to those described above for Alternative 1. However, the maximum developed area within the proposed SEZ under Alternative 2 would be 6,770 acres, and one wash would pass through the eastern portion of the proposed SEZ (Township 5 South, Range 11 West, Section 5). Acreages of conservation potential categories are presented in **Table 4-1**, Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative. There are no conservation potential category 2 lands within the proposed SEZ this alternative. Potential impacts would be minimized through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices.

Impacts from Alternative 3
Impacts from Load Offset REDA
Impacts for Alternative 3 would be similar to those described for Alternative 1. Conservation potential categories 1, 2, and 3 cover 79,900 acres, 18,700 acres, and 15,800 acres, respectively, of BLM-administered land within the REDA under Alternative 3.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on fish and wildlife would be similar to those described above for Alternative 1. However, the maximum developed area within the proposed SEZ under Alternative 3 would be 2,760 acres, and Alternative 3 would avoid all major washes. Acreages of conservation potential categories are presented in **Table 4-1**, Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative. There are no conservation potential category 2 lands within the proposed SEZ under Alternative 3. Potential impacts would be minimized through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Impacts for Alternative 4 would be similar to those described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on fish and wildlife would be similar to those described above for Alternative 1. The acres of the proposed SEZ for each conservation potential category are the same as those for Alternative 1 (**Table 4-1**, Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative). Potential impacts would be minimized through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Impacts for Alternative 5 would be similar to those described for Alternative 1. Conservation potential categories 1, 2, and 3 cover 16,800 acres, 11,200 acres, and 2,200 acres, respectively, of BLM-administered land within the REDA under Alternative 5.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Impacts for Alternative 6 would be similar to those described for Alternative 1. Conservation potential categories 1, 2, and 3 cover 110,300 acres, 90,500 acres, and 27,300 acres, respectively, of BLM-administered land within the REDA under Alternative 6.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on fish and wildlife would be similar to those described above for Alternative 1. However, the maximum developed area within the proposed SEZ under Alternative 6 would be 6,770 acres, and one wash would pass through the eastern portion of the proposed SEZ (Township 5 South, Range 11 West, Section 5). The acres of the proposed SEZ for each conservation potential category are the same as those for Alternative 2. Potential impacts would be minimized through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices.

4.2.7 Geology and Seismicity

Evaluation Methodology, Resource Indicators, and Assumptions

The potential effects of renewable energy development were evaluated by assessing the effects that anticipated future actions consistent with the alternatives would have on the geology and unique geologic resources of a project area. Indirect impacts could occur from subsequent development activities, including large-scale surface disturbances such as siting, construction activities, and reclamation/abandonment activities associated with renewable energy development.

Geologic features may contain paleontological or cultural resources or possess scenic or recreational values; impacts on these resources could also result in indirect impacts on the geologic feature. In this section, impacts on geologic features are evaluated only from the perspective of scientific value. Effects are quantified where possible; in the absence of quantitative data, qualitative descriptions and best professional judgment were used.

Seismic risk is more likely to impact renewable energy facilities than operation of the facilities is to increase seismic risk. None of the activities associated with current solar and wind energy technologies are likely to result in increasing seismic activity.

Subsidence can occur where groundwater is pumped from underground aquifers at a rate exceeding the rate that it is replenished. Most of the solar and wind development technologies require the use of water for construction, operations, and reclamation activities but at rates that would be unlikely to result in subsidence. Therefore, it is assumed that the potential for subsidence is low.

Impacts Common to All Alternatives

Large-scale unique geologic features (e.g., the Grand Canyon, the Vermilion Cliffs) are protected through designation as a national park or national monument. Smaller-scale unique geologic features (e.g., natural arches, caves, sources of unique geologic specimens) that are outside a national park, national monument, or designated wilderness, could be impacted by siting renewable energy development activities within their viewsheds or adjacent to their locations.

The potential impacts on geologic resources from renewable energy development mainly concern physical disturbance (e.g., movement, removal, or destruction). These impacts are considered long term, as they cannot be reclaimed. In most BLM RMPs, ROW areas must avoid sensitive geologic resources in order to be approved. Additional indirect impacts could result from greater public access to and atmospheric, visual, and aural intrusions on formerly inaccessible areas. Greater public access can result in increased wear and vandalism of sensitive geologic features. These impacts can be short term if roads are reclaimed.

Due to the inability to predict future development scenarios, including types of development, timing, and location, the following impact analysis provides a general description of common impacts on geologic features using four sequential phases: siting/design, construction, operations/maintenance, and reclamation of facilities (including any transmission lines, access roads, and collector cables) and abandonment. All these phases of renewable energy development could result in indirect impacts.. All components of a renewable energy project development (e.g., facilities, roads, etc.) would be at risk from geologic hazards if projects were in a seismically active area or prone to subsidence and land flows.

Impacts from the No Action Alternative

Under the No Action Alternative, renewable energy projects would be developed on a case-by-case basis through ROW authorizations in accordance with the BLM's existing land use plans and could result in higher or lower levels of consideration of and protections for unique geologic resources. The types of impacts on geologic resources that could occur would be similar to those described above as renewable energy projects are developed on available BLM-administered land. The number of acres likely to be affected under this alternative is unknown. Compliance with NEPA and conformance with

applicable BLM land use plans would still be required; in most BLM RMPs, ROW areas must avoid sensitive geologic resources in order to be approved, thereby reducing the potential for impacts. However, the No Action Alternative does not include additional design features or BMPs as described in **Appendix B**, , Design Features and Best Management Practices, which would give consistent, state-wide guidance for mitigating impacts resulting from renewable energy development. Mitigation would be determined on a project-by-project basis and as needed based on the impact analysis for a specific proposal.

Impacts from Alternative 1

Impacts from Maximum REDA

Under Alternative 1, there would be approximately 321,500 acres of BLM-administered land identified as available for priority renewable energy ROW application. Existing land use plans would be amended to reflect the goals, management actions, design features, and BMPs of this EIS, but individual field offices could modify these standards in keeping with pre-existing agreements on resource protections to create higher levels of protection in areas where development is currently governed through land use plan provisions or agreements.

Under Alternative 1, the potential for impacts on geologic resources would be the same as described under Impacts Common to All Alternatives. Impacts on geologic resources as well as reduced geologic hazards for projects would be reduced or avoided through consistent guidance for future renewable energy development, including building project structures in accordance with the design basis recommendations specified in the project-specific geotechnical investigation report (see **Appendix B**, Design Features and Best Management Practices, for a complete listing of requirements). Compliance with NEPA and conformance to applicable BLM land use plans would be required, further reducing the potential for significant impacts. It is expected that these measures, along with the measures outlined under visual resources, noise reduction, and air quality, would reduce the indirect impacts as a result of renewable energy development.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under this alternative, the proposed Agua Caliente SEZ would be 20,600 acres. There are no known unique or sensitive geologic resources within the boundary of the proposed SEZ or within five miles of its boundary; so, there would be no impacts. Additionally, the area is not known to be seismically active; therefore, risk of damage from seismic activity is considered negligible.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, there would be approximately 218,600 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be similar to those described for Alternative 1 and

Impacts Common to All Alternatives, and the suggested mitigation measures are the same.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed Agua Caliente SEZ would be 6,770 acres. The impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Alternative 3
Impacts from Load Offset REDA
Under Alternative 3, there would be approximately 129,800 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives, and the suggested mitigation measures are the same.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed Agua Caliente SEZ is 2,760 acres. The impacts would be to the same as those described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Under Alternative 4, there would be approximately 321,500 acres of BLM-administered lands available for renewable energy ROW application. The inclusion of additional water design features could indirectly result in reducing groundwater drawdown, further reducing the potential for subsidence. The anticipated impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives, and the suggested mitigation measures are the same.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed Agua Caliente SEZ would be 20,600 acres. The impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under Alternative 5, there would be approximately 43,700 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives, and the suggested mitigation measures are the same.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Under Alternative 6, there would be approximately 237,100 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives, and the suggested mitigation measures are the same.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under this alternative, the proposed Agua Caliente SEZ is 6,770 acres. The impacts would be similar to those described for Alternative 2, and Impacts Common to All Alternatives.

4.2.8 Land Use and Realty

Evaluation Methodology, Resource Indicators, and Assumptions

This section discusses impacts on land use and realty from proposed management actions, design features, and BMPs as noted in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning lands and realty are described in **Section 3.8**, Land Use and Realty. Impacts on land use and realty would result from actions that would alter existing or future land uses and access, increase the demand for or restrict the number or location of ROWs and other land use authorizations, or that would impact land tenure objectives on BLM-administered lands.

Land status baseline information in **Section 3.8**, Land Use and Realty, was reviewed for an understanding of current land use, lands and realty program goals, management practices, and ownership breakdown in the planning area. This known information was overlain with the actions found under each alternative in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, and conclusions were drawn based on an understanding of how these types of actions may affect BLM-administered lands.

The analysis was based largely on information available from public sources, which were used to identify existing authorizations for use of the BLM lands. Spatial analysis included the use of project-specific GIS. Google Earth was used to provide context to the analysis and to cross-reference information sources. Existing BLM land use plans were also consulted. The proposed Agua Caliente SEZ was visited by assessment team members to provide site familiarity. All analyses were conducted using the largest SEZ footprint. The BLM Arizona State Office staff was consulted on specific issues.

The specific impacts of development of solar and wind energy facilities would depend on project location, technology and scale employed, size of the development, and proximity to existing roads and transmission lines. On the basis of the assumptions given in the RFDS report (**Appendix A**, Reasonably

Foreseeable Development Scenario for Renewable Energy in Arizona), land disturbance for solar facilities would be about 8 acres per MW, and about 10 percent of the acres per MW capacity are assumed to be disturbed for wind facilities. However, due to the uncertainty of specific solar and wind development that would occur as a result of identifying lands within the REDA as available for solar and wind energy, it is not possible to quantify the total acreage affected on BLM lands within the decision area, other than to identify the acreage of land that could be affected by maximum build-out. Implementation-level actions (development of specific solar and wind facilities) would be subject to further environmental review and would include quantifying the total acreage affected by site-specific development.

Potential impacts on land use and realty could occur if reasonably foreseeable future actions were to result in the following:

- Conflict with management goals and objectives set forth by the BLM in order to sustain the health, productivity, and diversity of BLM lands; or
- Result in proposed uses that are incompatible with existing or adjacent land uses and access.

The analysis includes the following assumptions:

- Existing ROWs would be managed per the terms and conditions of the ROW grant.
- The BLM would continue to process land tenure adjustments; and
- The demand for ROWs would increase over the life of the RMPs.

Impacts Common to All Alternatives

BLM lands where solar and wind energy development might occur within the planning area support a wide variety of activities, as described in **Section 3.8**, Land Use and Realty. These uses are allowed by the BLM in accordance with existing land use plans and may be authorized through the issuance of ROWs.

There are several direct impacts related to the actions being considered as part of the RDEP, as described in the **Section 2.3.2**, Elements Common to All Action Alternatives. Development of solar and wind energy facilities would be subject to the terms and conditions of existing ROWs, and the BLM may change these existing ROW authorizations unless the authorization change is tied to federal law requirement (such as the ESA). If a holder of a ROW agreed to modify an existing ROW, the project developer likely would be financially responsible for the cost of any modifications. Once a solar or wind facility is authorized, the area would be excluded from use for other lands and realty purposes that are inconsistent with operation of the facility. Because of the

potentially large size of solar and wind facilities (i.e., utility scale), these exclusions could serve as substantial barriers to other uses and public access.

In addition to direct impacts, there may also be indirect impacts on lands and realty associated with solar and wind energy development. The indirect impacts would be associated with changes to existing uses on BLM lands that may be adjacent to new development. Increased traffic and access to previously remote areas also could change the overall character of the landscape, including the visual quality of large areas. These indirect impacts would vary project by project and would be analyzed at the site-specific level.

Because of the large land area needed for any utility-scale solar or wind facility, this type of development would fragment large blocks of BLM-administered land and may create isolated BLM land parcels that would be hard to manage. Topography, land ownership pattern, existing land use designations (e.g., wilderness), and new access routes or transmission facilities are examples of features that could all combine with a solar or wind energy development to create fragmentation of BLM-administered lands. Although access would be maintained to surrounding BLM-administered lands, there is the potential to sever or alter existing access routes, requiring new access provisions, new road construction, and additional ROW grants. The potential magnitude and nature of these impacts would be considered in project-specific analyses.

In most areas of the decision area, solar and wind energy development would create an industrial landscape in stark contrast to the character of the existing undeveloped landscape. These developments would be visually intrusive and would affect lands that surround them. This would be especially true for lands with special designations based on wilderness and scenic values, including national parks and components of the NLCS (see discussion in the respective sections of this chapter).

Access to electrical transmission facilities is a major factor in siting utility-scale solar and wind facilities; availability of established and adequate transmission corridors is becoming critical, especially as the demand for renewable energy sources increases. Because solar and wind facilities would not be allowed in designated utility corridors, there would not be a reduction of the land available for use for other transmission facilities.

Due to the inability to predict future development scenarios, including types of technology, scale, timing and location, the following impact analysis provides a general description of common impacts on land use from solar and wind development. The actual amount of land required for specific solar or wind energy facilities will vary based on site-specific assessments of areas that need to be avoided and required distance from other pre-existing structures. Identifying land available for solar and wind development in the REDA and in the various proposed Agua Caliente SEZ would not create any direct impacts, including surface disturbances.

Impacts on land uses in the decision area include the possibility for increased traffic as a result of new or enhanced roads developed during the construction phase of solar and wind development. Additional roads could improve motorized and nonmotorized access to previously inaccessible areas, thereby increasing motorized traffic in those areas and possibly affecting activities such as grazing and recreation. The magnitude and extent of the impact would depend on the current land use in the specific area proposed for development, which is unknown at this time. The impact would last for the duration that the roads were in use (short term for construction phase, longer term during operation) but would be expected to be reclaimed in the reclamation and abandonment phase.

Lands converted to solar and wind use (CSP or PV power plants, wind turbines, access routes, and transmission lines) would result in long-term impacts on other uses such as grazing, recreation, hunting, and mining as development would displace these activities and uses. Short-term (lasting only the duration of the actual activity) impacts would include maneuvering construction and maintenance equipment and vehicles associated with the construction and operation activities.

Reclamation and abandonment activities include dismantling solar and wind facilities and reclaiming all disturbed areas. All disturbed lands would be reclaimed in accordance with BLM standards, and land uses and activities could resume according to applicable regulations.

Aviation Considerations

Developers of renewable energy facilities would have to consider the needs of, and likely restrictions posed by, nearby military and civilian aviation facilities, installations, airspace, and activities. The following subsections identify military and civilian aviation and other considerations affecting solar and wind development.

Development of solar facilities has the potential to affect both military and civilian aircraft operations, radar use, and other operations. Numerous civilian airfields, MTRs, SUAs, and Restricted Areas are located within the study area. The military airspace in the study area is intensively used and is important to maintaining overall training and readiness for all branches of the military. Many issues must be considered as part of the decision-making process in siting both utility-scale solar energy production facilities and transmission facilities, especially intrusion of facilities into low-level airspace in military training areas, and near military and civilian airports. If the project site is in the proximity of a military or civilian airport, or a common aircraft flight path, the potential for glint and glare from reflective surfaces to adversely affect pilot control of aircraft would have to be considered as potential aircraft hazards. Consideration of the effect of military overflights, especially supersonic flights, on solar facilities

should be considered (e.g., the potential for solar field equipment damage) as part of project design and location.

In addition, effects on airborne and ground-based radars, including weather radar, must be understood. Potential effects on aircraft performance and on pilots, such as the creation of thermal plumes, glare, and light pollution in both the visible and infrared spectra, are poorly understood and require further study. Finally, many planned solar facilities use wireless-controlled aiming devices to focus reflected sunlight on collecting towers. The effects of airborne electronic jamming in nearby military operating areas are not understood and could conceivably cause the mirrors to point in an unintended direction, thereby creating potential safety-of-flight impacts or other concerns.

The FAA will be involved in reviewing potential air space conflicts, including any solar energy facility construction proposed in proximity to civilian airports. The Obstruction to Navigation Federal Regulation (49 CFR Part 77) requires FAA approval of any project taller than 200 feet. An FAA Finding of No Hazard to Air Navigation does not address all military airspace and other issues; coordination with the military command responsible for management of the training space is still required.

Additional technology-specific impacts and considerations can be reviewed in the Solar PEIS (BLM and DOE 2010; pg. 5-18 through 5-19). Because a solar energy development project would have to meet appropriate military and FAA criteria, no adverse impacts on aviation would be expected.

For wind energy projects, the FAA requires a notice of proposed construction for a project so that it can determine whether it would adversely affect commercial, military, or personal air navigation safety (BLM 2005b). One of the triggering criteria is whether the project would be located within 20,000 feet or less of an existing public or military airport, depending upon the type of airport or heliport. If the potential site for a wind energy development project is known, an Internet database can be searched online to obtain this information (AirNav.com). Inputting the geographic coordinates allows identification of public, private, and military airports; balloon ports; glider ports; heliports; seaplane bases; short takeoff and landing airports (STOLports); and ultralight flight parks within a minimum radius of 6 miles to a maximum of 200 miles. Another FAA criterion triggering the notice of proposed construction is any construction or alteration of more than 200 feet in height above ground level. This criterion applies regardless of the distance from the proposed project to an airport (BLM 2005b). Because a wind energy development project would have to meet appropriate FAA criteria, no adverse impacts on aviation would be expected.

Additionally, wind energy developments could be in conflict with existing or proposed military testing and training operations. Military testing and training exercises involve the use of aircraft (sometimes in restricted air space), ground

troops, and weapons (including guided missiles). Restricted air space allows for real-world maneuvering room for high-speed military aircraft, while providing large buffer zones surrounding the test ground to ensure public safety (BLM 2005b). However, military test ranges are being challenged by encroachments such as population growth, urban expansion, growing airspace congestion, and, even as a result of the unintended consequences of environmental laws that reduce the flexibility of military training (BLM 2005b). The presence of turbines, permanent meteorological towers, and aboveground transmission lines associated with wind energy projects could add additional constraints to military testing and training operations that may occur at low altitudes (e.g., helicopter low-altitude tactical navigation areas, military operations areas, and military training routes). These structures may also be a source of ground-based and, more importantly, aircraft radar interference. The aforementioned constraints to military testing and training operations could be the basis for denial of a ROW authorization should there be no available mitigation alternatives.

Land Tenure

Where appropriate, the BLM would consider disposing of BLM-administered lands within the REDA via exchange and acquire non-federal lands within high-conservation priority areas. Determining when and which available parcels would be candidates for exchange would be consistent with local BLM and county land use plans. Disposing or acquiring lands would be consistent with goals of the BLM lands and realty program to manage public lands to support the goals and objectives of other resource programs, provide for uses of public lands in accordance with regulations and compatibility with other resources, and improve management of public lands through land ownership adjustments.

Renewable Energy

Under all alternatives, solar, wind and biomass project applications would be evaluated by the BLM on a case-by-case basis and would be processed to minimize or avoid impacts on sensitive resources in the natural or human environment. The number of renewable energy projects is expected to increase across the state in response to regulatory mandates and market demand for renewable energy. As detailed in the RFDS report (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona), it is estimated that 1.5 GW of renewable energy capacity would be developed on 12,000 acres of BLM lands by 2025. All REDA alternatives would provide sufficient land for the fulfillment of this estimate, since the acreages of BLM-administered lands range from 48,000 to 334,500.

Impacts from the No Action Alternative

Under this alternative, solar and wind energy projects would be developed on a case-by-case basis in accordance with current BLM land use plan decisions. BLM would identify existing land use conflicts and address the associated environmental impacts during the application process. However, in the absence of identifying the REDA, solar and wind project development would likely result

in fragmented and segregated land uses and access, and thereby not meet BLM's land use goals. Developments may be in areas of high-resource conflict and result in delays in processing ROW applications, or in increases in the cost of developing renewable energy on BLM-administered lands. Developers could respond by focusing their development efforts on state-owned, tribal, and private lands. Additionally, there could be increased unanticipated environmental impacts from the lack of planning for appropriate land uses, such as visual intrusions on sensitive landscapes, and could alter the character of rural areas.

As necessary, individual BLM land use plans may have to be amended for individual projects as a part of the project evaluation and approval, which could further delay decision making.

Impacts from Alternative 1

Impacts from Maximum REDA

Land Use and Access. As discussed throughout this EIS, not all BLM-administered lands are appropriate for solar or wind energy development. Under Alternative 1, certain categories of land that are known or believed to be unsuitable for solar and wind development would be excluded from development to guide solar and wind energy developers to areas where there are fewer resource conflicts and potential controversy. This screening process, described in **Section 2.2**, Alternative Development Process, would allow time and effort to be directed to those projects that have less likelihood of resulting in land use conflicts.

Under Alternative 1, the BLM would identify a renewable energy potential development area of approximately 321,500 acres of BLM-administered land. All of the impacts described in Impacts Common to All Alternatives would apply to Alternative 1. In the REDA, solar and wind energy development would preclude other land uses within any project footprint and could alter the character of rural areas if development occurred in these undeveloped areas. Development of supporting infrastructure (e.g., new transmission lines, roads) would also locally impact land use.

The large boundary for the REDA would provide opportunities to site future solar and wind facilities in areas that may be more appropriate for this type of use, and to minimize conflicts with other land uses and to surrounding public lands.

As discussed in **Section 2.3.3**, Alternative 1: Maximum REDA, legal access would be maintained to surrounding public lands; however, existing access to these areas may be altered. Areas where potential development is physically located would likely be closed to public access (e.g., if development is where a road is, the road might be rerouted around the development or moved to a different location). The large boundary for the REDA would provide opportunities to minimize conflicts to public access, including access to surrounding public lands, due to more land available for siting access routes.

However, the larger REDA would reduce access on public lands around the REDA.

Implementing the management actions, design features, and BMPs noted in **Section 2.3.3**, Alternative 1: Maximum REDA, would provide adequate mitigation for land use, access, and realty activities. In addition to these, the following mitigation measures are proposed to further reduce impacts on access issues (summarized in **Table 4-35**, Additional Mitigation Measures, at the end of this chapter):

- Consolidation of access and other supporting infrastructure should be considered for single projects and for cases in which there is more than one project in close proximity to another to maximize the efficient use of public land.
- Where there are existing BLM ROW authorizations within development areas, pursuant to Title 43, Part 2807.14 of the Code of Federal Regulations (43 CFR 2807.14), the BLM would notify ROW holders that an application that might affect their existing ROW has been filed and would request their comments. Early discussion with existing ROW holders should occur to ensure their interests are protected and any issues are resolved.

It is expected that all of these measures would effectively avoid or reduce impacts over the long term on land uses by identifying conflicts early in the process and requiring specific measures to maintain public use, access, and values.

Renewable Energy. Full development of the REDA under Alternative 1 is assumed to involve solar energy production on 80 percent of the 321,500 identified acres. At a rate of 8 acres per MW, development of the 257,200 acres would result in an estimated electrical capacity of 32.2 GW. About 1,400 acres of the REDAs under Alternative 1 have been identified as having wind potential of Class 3 or greater. Class 2 lands comprise 43,300 acres of the REDA under this alternative. Class 2 wind resources are generally considered less desirable for development; however, the data source used for analysis is the result of a nationwide modeling effort. These wind estimates include a margin of error that could result in some areas identified as Class 2 having actual wind speeds higher than those defined by that class. Additionally, the DOE wind data was based on theoretical modeling and not actual site-specific wind measurements. Wind speeds vary greatly based on localized topography and can only be verified through meteorological monitoring over time. Many applications for wind projects proposed in Arizona have project footprints on lands identified as Class 2. Wind development in these areas would likely involve other non-BLM surface-management agencies and land owners. Combined, the Class 2 and Class 3 lands comprise 44,700 acres. At a rate of 28 acres per megawatt,

development on 10 percent (4,470 acres) of these lands would result in an estimated electrical capacity of 1.6 GW.

Impacts from Proposed Agua Caliente Solar Energy Zone

Construction and Operations. Identifying the proposed Agua Caliente SEZ would reduce the demand for utility-scale solar projects on other BLM lands in Arizona, and focus industrial land use in areas more suitable to this type of development. Development of the proposed Agua Caliente SEZ for utility-scale solar energy production would establish a large industrial area that would exclude existing and potential uses of the land, perhaps in perpetuity. If the proposed Agua Caliente SEZ were developed, there would be conflict with existing land use (primarily recreation) within the proposed Agua Caliente SEZ. Impacts could be dispersed across the 20,600-acre site.

The proposed Agua Caliente SEZ is located adjacent to a 290-MW solar facility currently under construction on private land. Utility-scale solar energy development on the proposed site would be consistent with this type of use; however, since the proposed SEZ is mainly surrounded by rural and undeveloped lands, development of utility-scale solar energy would contribute to the increase of industrial-type land uses in the area. The relatively large boundary for the proposed Agua Caliente SEZ would provide opportunities to site future solar facilities in areas that may be more appropriate for this type of use and to minimize conflicts with other land uses.

As discussed in **Section 2.3.3**, Alternative 1: Maximum REDA, legal access would be maintained to the proposed Agua Caliente SEZ and surrounding BLM and state lands; however, existing access to these areas may be altered. Areas where potential development is physically located would likely be closed to public access (e.g., if development is right where a road is, the road might be rerouted around the development or moved to a different location). The large boundary for the proposed Agua Caliente SEZ would provide opportunities to minimize conflicts to public access, including access to surrounding BLM and state lands, due to more land available for siting access routes. However, the larger SEZ would reduce access on public lands around the SEZ.

Existing ROW authorizations in the proposed Agua Caliente SEZ are prior existing rights, and facilities within the ROWs would not be adversely affected by solar energy development. Should the proposed SEZ be identified in the ROD for this EIS, the BLM would still have discretion to authorize additional ROWs in the area until solar energy development was authorized, and then future ROWs would be subject to the rights granted for solar energy development. Because the area currently has one ROW present (a pipeline that runs east-west), it is not anticipated that approval of solar energy development would have a significant impact on public land available for future ROWs in the area.

Transmission Facilities and Other Off-Site Infrastructure. Transmission lines and access roads would be constructed within the proposed Agua Caliente SEZ as part of the development of the area. Delivery of energy produced in the proposed Agua Caliente SEZ would require establishing connection to the regional grid. For analysis purposes, it is assumed that initial connection to the grid would be made to an existing 500-kV transmission line that is located approximately 0.5-mile south of the southern boundary. Due to the relatively large area of the proposed Agua Caliente SEZ, future solar facilities may be constructed at distances of up to approximately eight miles from this transmission line. This would require constructing the necessary infrastructure to establish connections to the existing transmission line.

Palomas Road is also located approximately 0.5-mile south of the proposed Agua Caliente SEZ, and it is assumed that access roads would be required to access the site via this road. Similar to transmission connections, future access roads may need to be provided for projects located at distances of approximately eight miles from Palomas Road.

Implementing the programmatic design features (e.g., stakeholder coordination/consultation, consolidation of infrastructure) described in **Appendix B**, Design Features and Best Management Practices, the management actions noted in **Section 2.3.3**, Alternative 1: Maximum REDA, and additional mitigation measures noted for Alternative 1 would effectively avoid or minimize impacts over the long term on land uses, including public access, by identifying conflicts early in the process and requiring specific measures to maintain public uses and values.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, the BLM would identify a renewable energy potential development area of approximately 218,600 acres of public land. All of the impacts described for Impacts Common to All Alternatives would apply to Alternative 2. Solar and wind energy development would preclude other land uses within a project footprint and could alter the character of rural areas if development occurred in these undeveloped areas. Development of supporting infrastructure (e.g., new transmission lines, roads) would also locally impact land use.

Impacts on land use and realty would be similar to Alternative 1. The necessary transmission connections would be less due to the REDA boundaries being closer to existing infrastructure. However, due to the small size of the decision area, there would be less flexibility in siting solar and wind facilities and infrastructure. This would likely result in more land use and access conflicts within the boundaries of the proposed REDA. Similar to Alternative 1, legal access would be maintained to surrounding public lands; however, existing

access to these areas may be altered. The smaller REDA would allow for more access on public lands around the REDA.

Renewable Energy. Full development of the REDA under Alternative 2 is assumed to involve solar energy production on 80 percent of the 218,600 identified acres. At a rate of 8 acres per MW, development of the 174,880 acres would result in an estimated electrical capacity of 21.9 GW. No lands with wind resource Class 3 or higher were identified in the Alternative 2 REDAs. Class 2 lands comprise 28,000 acres of the REDAs under this alternative. At a rate of 28 acres per megawatt, development on 10 percent (2,800 acres) of these lands would result in an estimated electrical capacity of 1 GW.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on land use and realty would be similar to Alternative 1. Overall, impacts on existing land use (primarily recreation) on BLM lands would be reduced because of the smaller footprint, as it does not include the northern area where most recreational hunting occurs (see **Section 3.15**, Recreation). However, due to the small size of the decision area, there would be less flexibility in siting a solar plant and infrastructure. This would likely result in more land use and access conflicts within the boundaries of the proposed Agua Caliente SEZ. Similar to Alternative 1, legal access would be maintained to surrounding BLM and state lands. The smaller proposed Agua Caliente SEZ would allow for more access on public lands around the proposed SEZ.

The necessary transmission connections and access roads would be less due to the boundaries being closer to existing infrastructure (approximately five miles). Because there are no existing ROWs, this alternative would have no impacts on existing ROWs and would not have a significant impact on public land available for future ROWs in the area.

Impacts from Alternative 3

Impacts from Load Offset REDA

Under Alternative 3, the BLM would identify a renewable energy potential development area of approximately 129,800 acres of public lands. All of the impacts described for Impacts Common to All Alternatives and Alternative 2 would apply to Alternative 3.

Impacts on land use and realty would be similar to Alternative 2. However, because solar and wind development would be concentrated near developed areas (e.g., cities, towns, or industrial areas), this type of development would likely be more consistent with surrounding land uses and would impact fewer rural landscapes. In addition, fewer transmission connections would be necessary due to the REDA boundaries being closer to existing infrastructure and load centers.

Due to the small size of the decision area, there would be less flexibility in siting solar and wind facilities and infrastructure. This would likely result in more land

use and access conflicts within the boundaries of the REDA. The smaller REDA would allow for more access on public lands around the REDA.

Renewable Energy. Full development of the REDA under Alternative 3 is assumed to involve solar energy production on 80 percent of the 129,800 identified acres. At a rate of 8 acres per MW, development of the 103,840 acres would result in an estimated electrical capacity of 13 GW. No lands with wind resource Class 3 or higher were identified in the REDAs under Alternative 3. Class 2 lands comprise 2,300 acres of the REDAs under this alternative. At a rate of 28 acres per megawatt, development on 10 percent (230 acres) of these lands would result in an estimated electrical capacity of 82 MW.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on land use and realty would be similar to Alternative 2. Impacts could be dispersed across the 2,760-acre proposed Agua Caliente SEZ. However, due to the small size of the decision area, there would be less flexibility in siting a solar plant and infrastructure. This would likely result in more land use and access conflicts within the boundaries of the proposed Agua Caliente SEZ. The smaller proposed Agua Caliente SEZ would allow for more access on public lands around the REDA. The transmission connections and access roads would be less due to the boundaries being closer to existing infrastructure (approximately three miles).

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Under Alternative 4, the BLM would identify a renewable energy potential development area of approximately 321,500 acres of public lands (the same as Alternative 1). All of the impacts described for Impacts Common to All Alternatives and noted for Alternative 1 would apply to Alternative 4. Implementing the water design features, included as part of the water resource protection levels, may limit solar development to dry-cooling technologies only. The actual amount of land required for dry-cooling solar facilities would vary based on site-specific assessments of areas that need to be avoided and required distance from other pre-existing structures.

Renewable Energy. Full development of the REDA under Alternative 4 would result in similar energy production to that described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on land use and realty would be the same as Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under Alternative 5, the BLM would identify a renewable energy potential development area of approximately 43,700 acres of public lands. All of the impacts described for Impacts Common to All Alternatives would apply to Alternative 5. Solar and wind energy development would preclude other land

uses within a project footprint and could alter the character of rural areas if development occurred in these undeveloped areas. Development of supporting infrastructure (e.g., new transmission lines, roads) would also locally impact land use.

Impacts on land use and realty would be similar to Alternative 1. Disposal of lands identified in this alternative would be consistent with goals of the BLM lands and realty program to manage public lands to support the goals and objectives of other resource programs, provide for uses of public lands in accordance with regulations and compatibility with other resources, and improve management of public lands through land ownership adjustments.

Due to the small size of the decision area, there would be less flexibility in siting solar and wind facilities and infrastructure. This would likely result in more land use and access conflicts within the boundaries of the proposed REDA. The smaller REDA would allow for more access on public lands around the REDA.

Renewable Energy. Full development of the REDA under Alternative 5 is assumed to involve solar energy production on 80 percent of the 43,700 acres identified. At a rate of 8 acres per MW, development of the 34,960 acres would result in an estimated electrical capacity of 4.4 GW. No lands with wind resource Class 3 or higher were identified in the REDAs under Alternative 5. Class 2 lands comprise 4,100 acres of the REDAs under this alternative. At a rate of 28 acres per megawatt, development on 10 percent (410 acres) of these lands would result in an estimated electrical capacity of 146 MW.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Under Alternative 6, the BLM would identify a renewable energy potential development area of approximately 237,100 acres of public lands. All of the impacts described for Impacts Common to All Alternatives would apply to Alternative 6. Solar and wind energy development would preclude other land uses within a project footprint and could alter the character of rural areas if development occurred in these undeveloped areas. Development of supporting infrastructure (e.g., new transmission lines, roads) would also locally impact land use.

Impacts on land use and realty would be similar to Alternatives 2, 3, and 4. This alternative would focus development of solar and wind facilities near existing load centers and transmission interconnections. Because solar and wind development would be concentrated near developed areas (e.g., cities, towns, or industrial areas), this type of development would likely be more consistent with surrounding land uses and would impact fewer rural landscapes. In addition, the necessary transmission connections would be less due to the REDA boundaries being closer to existing infrastructure and load centers. Disposal of BLM-administered lands identified in this alternative would be consistent with goals of the BLM lands and realty program to manage public

lands to support the goals and objectives of other resource programs, provide for uses of public lands in accordance with regulations and compatibility with other resources, and improve management of public lands through land ownership adjustments.

Renewable Energy. Full development of the REDA under Alternative 6 is assumed to involve solar energy production on 80 percent of the 237,100 identified acres. At a rate of 8 acres per MW, development of the 189,680 acres would result in an estimated electrical capacity of 23.7 GW. No lands with wind resource Class 3 or higher were identified in the REDAs under Alternative 6. Class 2 lands occur on 28,100 acres of the REDAs under this alternative. At a rate of 28 acres per megawatt, development on 10 percent (2,810 acres) of these lands would result in an estimated electrical capacity of 1 GW.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on land use and realty would be the same as Alternative 2.

4.2.9 Livestock Grazing

Evaluation Methodology, Resource Indicators, and Assumptions
This analysis addresses potential impacts on livestock grazing from implementing the management actions under the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning livestock grazing are described in **Section 3.9**, Livestock Grazing. This analysis focuses on solar and wind energy development that has the potential for disturbance of livestock or alterations to authorized grazing allotments whether in availability of use or due to changes in forage availability.

Site-specific impacts would be influenced by location, magnitude, technology, type of development, and soil and vegetation conditions of developed sites.

Impacts would be considered significant if:

- Management action leads directly or indirectly to a decrease in permitted AUMs in areas that are currently available to livestock grazing due to resource conflicts; or
- Management action prohibits the ability to construct range improvements and conduct treatments (infrastructure and vegetation).

This analysis assumes the following:

- Grazing activities would be excluded from areas developed for utility-scale solar energy production but may be compatible with other solar or wind development.

- All existing leases and permits would be subject to terms and conditions by the authorizing officer as established by BLM regulations.
- Vegetation would be reestablished through reclamation practices upon decommissioning of renewable energy projects to the standards required by BLM regulations and project-specific design criteria.
- Livestock grazing on public lands is tied to permittee-owned or controlled base property on private land.

Impacts Common to All Alternatives

Where grazing occurs on public lands, it is authorized either through a grazing permit or lease, as described in **Chapter 3**, Affected Environment. BLM grazing regulations provide that permits or leases can be cancelled with a two-year notification to the grazing permittee (CFR 4110.4-2(b)). The grazing regulations also provide for reimbursement to grazing permittees for their share of the value of range improvements. Depending on site-specific conditions, reductions in authorized grazing use may be necessary for individual leases/permits because of the loss of all or a portion of the forage base and/or range improvements (e.g., fencing, water development, seedlings) supporting the grazing operation.

The portions of grazing permits or leases within areas developed for utility-scale solar energy production that would become unavailable for grazing and leases would be cancelled or modified. On the basis of the amount of land required for comparably rated facilities, power tower, dish engine, and PV technologies require about 80 percent more land area than parabolic trough technologies, resulting in larger areas being excluded from grazing use (BLM and DOE 2010). Non-utility-scale solar would have a smaller footprint and reduced impacts. In addition, wind farms would generally not prevent livestock grazing other than in the areas physically occupied by towers or service roads. The Dry Lake Wind Project, the first commercial wind farm in Arizona, is an example of a large wind operation on which livestock grazing is a compatible use (Arizona Cattlelog 2010).

Impacts could occur from renewable energy siting and exploration, operations and maintenance, and reclamation and abandonment, as well as associated transmission lines. Impacts include but are not limited to:

- Social and economic impacts on individual ranchers and communities where ranching is historically important due to loss of public grazing land;
- Degradation of grazing land due to changes to rangeland from increased human influences, including spread of noxious weeds and increased potential from wildfire; and

- Increased chance of cattle injury or death from vehicular collision due to additional roads and increased traffic associated with development.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind development by statute, regulation, or orders would remain excluded, and administratively excluded areas would be assessed based on management in local land use plans. Impacts on grazing would be assessed on a project-specific level. In the absence of identifying the REDA, solar and wind project development would likely result in patchy, fragmented development. In addition, no standard set of design features or BMPs would be developed for protection of livestock grazing resources.

Impacts from Alternative 1

Impacts from Maximum REDA

Indirect impacts on rangeland and livestock grazing would result from implementing the planning decisions and possible future ground-disturbing activities associated with construction of renewable energy facilities. A total of 321,500 acres of grazing allotments would occur within the Alternative 1 REDA. Potential impacts include reductions in authorized grazing use (AUMs) and loss of range improvements described under Impacts Common to All Alternatives. The degree of impact would depend upon the location, size, and acres disturbed for development within the REDA.

Design features and BMPs include provisions to prevent livestock disturbance, including appropriate fencing, cattle guards, and signs (**Appendix B**, Design Features and Best Management Practices).

Impacts from Proposed Agua Caliente Solar Energy Zone

The entire proposed SEZ (20,600 acres) is located within the Palomas allotment. This ephemeral allotment has had no grazing in the recent past; therefore, impacts on livestock grazing would be negligible.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

A total of 218,600 acres of grazing allotments would occur within the Alternative 2 REDA. The nature and type of impacts would be similar to those described for Alternative 1; however, the impacts would occur over a smaller area.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts would be similar to those described for Alternative 1, except that the proposed SEZ in Alternative 2 encompasses a total of 6,730 acres. Therefore, impacts would occur over a smaller area.

Impacts from Alternative 3

Impacts from Load Offset REDA

A total of 129,800 acres of grazing allotments would occur within the Alternative 3 REDA. The nature and type of impacts would be similar to those described for Alternative 1; however, the impacts would occur over a smaller area.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be similar to those described under Alternative 1; however, under Alterative 3, the proposed SEZ encompasses 2,760 acres. As such, impacts would occur over a smaller area.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Impacts would be the same as those described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be the same as those described for Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

A total of 43,700 acres of grazing allotments would occur within the Alternative 5 REDA. The nature and type of impacts would be similar to those described for Alternative 1; however, the impacts would occur over a smaller area.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

A total of 237,100 acres of grazing allotments would occur within the Alternative 6 REDA. The nature and type of impacts would be similar to those described for Alternative 1; however, the impacts would occur over a larger area.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be the same as those described for Alternative 2.

4.2.10 National Trails

Evaluation Methodology, Resource Indicators, and Assumptions

Impacts were evaluated by analyzing the number of acres of the REDA and the proposed Agua Caliente SEZ occurring within a five-mile buffer of the three national trails identified in **Section 3.10**, National Trails. These trails, along with a 0.25-mile buffer on either side, were removed from the REDA under all alternatives. A five-mile buffer from the trail corridors was used as the region of influence for analysis. For the purposes of this analysis, five miles was considered to be a reasonable distance to consider visual impacts for most landscapes under most circumstances. Thus, for each alternative, the analysis identifies the

number of acres of REDA lands that occur within 5 miles of the trail corridors, or within 5.25 miles of the actual trail footprints.

Potential impacts on national trails could occur if future actions were to result in:

- Conflict with management goals and objectives set forth by the agency or agencies responsible for trail-wide management and by the BLM with on-site jurisdiction in order to sustain these resources and their visual or historic qualities;
- Proposed uses that are incompatible with maintaining identified trails and the qualities for which the trails were designated within and adjacent to their boundaries;
- Utilize all or any portion of a trail during any phase of renewable energy project development; or
- Install facilities or transmission lines within a trail's historic or scenic landscape.

BLM would coordinate with the NPS as part of NEPA analysis for site-specific projects regarding impacts on any potentially affected trails, and such impact concerns would be addressed through modifications to project plans or through mitigation.

Impacts Common to All Alternatives

The types of impacts that could occur on national trails from renewable energy development would be similar to those described for cultural resources (see **Section 4.2.3**, Cultural Resources). Specifically, impacts could result in several ways, including the following:

- Degradation and/or destruction could result from the alteration of topography, alteration of hydrologic patterns, removal of soils, erosion of soils, and runoff into and sedimentation of adjacent areas if trails are located near the project area; and
- Visual degradation of settings associated with national trails could result from the presence of an utility-scale solar energy development and associated land disturbances and ancillary facilities. This would affect national historic trails for which visual integrity is a component of the trails' significance, such as its historic landscape, associated historic structures, and possible archaeological sites.

Impacts from the No Action Alternative

Under the No Action Alternative, ROW applications would continue to be processed according to restrictions outlined in the applicable RMP. Impacts on

national trails would be considered during NEPA analysis for new ROWs. The number of acres likely to be affected under this alternative is unknown.

The case-specific studies required prior to issuance of a ROW grant would be expected to prevent many impacts on national scenic and historic trails. Development would require construction of facilities and transmission lines, which could alter the historic or scenic landscape of the affected trails. Under this alternative, no comprehensive list of design features and BMPs would be distributed to serve as consistent guidance for future renewable energy development. This would result in fragmented and segregated planning for preventing impacts on national scenic and historic trails, which often exponentially increases recognized environmental impacts. Due to the uncertainty of total acreage considered for ROWs under this alternative, it is not possible to quantify the total acreage affected on BLM-administered lands.

Impacts from Alternative 1

Impacts from Maximum REDA

Approximately 22,000 acres of BLM-administered lands within the Maximum REDA occur within 5.25 miles of the 3 National Trails in the planning area. Renewable energy development on these lands would require construction of facilities and transmission lines, which could alter the historic or scenic landscape of the affected trails.

Under Alternative 1, the BLM land use plans identified in **Section 1.5.1**, Decisions on the REDA, would be amended to include management actions, design features, and BMPs that would reduce impacts on national scenic and historic trails. Specifically, the cultural resources management action detailed under **Section 2.3.3**, Alternative 1: Maximum REDA, would allow the BLM to restrict surface-disturbing activities within the viewshed of portions of a trail that are potentially eligible for listing on the NRHP and for which eligibility is tied to the visual setting.

Impacts from Proposed Agua Caliente Solar Energy Zone

The Juan Bautista de Anza National Historic Trail corridor is located approximately five miles south of the proposed SEZ, and some developments, such as CSP towers, may be visible from the trail. To the extent that visual resources contribute to the trail's significance, the experience from the trail could be impacted by landscape modifications in the proposed SEZ. See **Section 4.2.22**, Visual Resources, for more information.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Impacts on national trails under Alternative 2 would be the same as described for Alternative 1, except that the acreage of BLM-administered lands within the REDA that occurs within 5.25 miles of the 3 national trails would be 17,500 acres.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
Impacts on national trails under Alternative 4 would be the same as described under Alternative 1, except that the acreage of BLM-administered lands within the REDA that occurs within 5.25 miles of the 3 national trails would be 17,800 acres.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Impacts on national trails under Alternative 3 would be the same as described under Alternative 1. The acreage of BLM-administered lands within the REDA that occurs within 5.25 miles of the 3 national trails would be 22,000 acres.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Impacts on national trails under Alternative 5 would be the same as described under Alternative 1, except that the acreage of BLM-administered lands within the REDA that occurs within 5.25 miles of the 3 national trails would be 4,700 acres.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
Impacts on national trails under Alternative 6 would be the same as described under Alternative 1, except that the acreage of BLM-administered lands within the REDA that occur within 5.25 miles of the 3 national trails would be 21,800 acres.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

4.2.11 Native American Interests and Heritage Resources

Evaluation Methodology, Resource Indicators, and Assumptions
Tribal coordination and consultations on programmatic actions, including identifying REDAs and the proposed Agua Caliente SEZ were initiated prior to public scoping efforts and have continued through the course of the EIS process. Identifying a REDA or a SEZ is a land use planning decision that does not grant any rights or authorize any specific activities that immediately affect tribal

interests or resources; therefore, the impact analysis focuses on the anticipated future actions consistent with the implementation of the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario.

BLM policy states that BLM shall consult with affected tribes to identify and consider their concerns in land use planning and decision making (Manual 8120, Tribal Consultation under Cultural Resource Authorities). The purpose of consultation is also to coordinate BLM and tribal land use policies and programs, and to seek consistency between land use plans affecting public land and tribal land. The purposes of tribal consultation under NEPA are to identify potential conflicts that would otherwise not be known to the BLM, and to seek alternatives that would avoid, reduce, or resolve the conflicts.

In initiating and continuing government-to-government consultations, the BLM contacted 23 affected federally recognized Indian tribes to identify tribal interests, treaty rights, and heritage resources within the RDEP planning area and the area specifically associated with the proposed Agua Caliente SEZ. A summary of tribal coordination and consultation actions is presented in **Chapter 6**, Consultation and Coordination. Also, all laws, regulations, and policies pertinent to determining effects on tribal interests and resources (such as Executive Order 13007, Native American Sacred Sites) were considered and included in the impacts criteria. This known information was overlain with the actions found under each alternative in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, and conclusions were drawn based on an understanding of how these types of actions may affect known resources and those yet to be identified by tribes through project-specific consultations or ethnographic studies.

Potential impacts on tribal interests or heritage resources could occur if anticipated future actions consistent with implementing the actions described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, were to result in the following:

- Conflict with land uses, management, and the economic wellbeing of adjacent or nearby reservations, trust lands, restricted Indian allotments, and federally tribal-dependent Indian communities;
- Conflict with the exercise of off-reservation treaty and reserved rights, including grazing rights, hunting and fishing rights, gathering rights and interests, and water rights;
- Conflict with federal trust responsibilities to tribes and individual Indians regarding real property, physical assets, or intangible property rights;

- Conflict with existing court decisions, laws, policies, executive orders, and agency agreements with tribes regarding land and resource use;
- Result in activities that are incompatible with the continued existence or use of places of traditional religious and cultural importance;
- Have an adverse effect on historic properties or their settings, including traditional cultural properties eligible for the NRHP under Section 106 of the NHPA (36 CFR 800);
- Impact or restrict access to traditionally used hunting, fishing, and gathering areas and species;
- Have an adverse effect on culturally important plant or animal species;
- Change or reduce access to traditionally used or culturally important water sources, including springs; or
- Impact sacred sites or their settings, access, or use.

This analysis assumes the following:

- Areas proposed for renewable energy development within a REDA or the proposed SEZ could include lands where there are tribal interests and heritage resources that are not currently identified; and
- The BLM would coordinate with Indian tribal governments to identify issues and concerns during all phases of the NEPA and NHPA Section 106 processes and would consult with tribes to accomplish avoidance, mitigation, and resolution of adverse effects.

Impacts Common to All Alternatives

Types of impacts that could occur from the phases of renewable energy development (e.g., siting/design, construction, operations and maintenance, and reclamation/abandonment) include direct disturbance of locations associated with traditional beliefs, resource gathering or hunting areas, water sources, ancestral sites, human remains, and trails. Other impacts could result from alterations of visual, aural, and atmospheric aspects of the setting of a place of traditional religious or cultural importance; increased public access, which could lead to incidents of vandalism or unauthorized collection of ancestral sites; decreased tribal member access or interference with cultural uses and practices such as resource gathering or hunting; and the potential for erosion, pollution, habitat loss, and less tangible changes to natural features and resources that tribal members may consider as traditionally important to their culture or are located on tribal lands near a REDA (for example, lands owned by the Pueblo of

Zuni near the REDA potentially suitable for wind energy development in eastern Arizona).

While it may be possible to restore visual and aural settings and some habitats, it is possible that some cultural uses and religious value may be permanently lost.

The following discussion analyzes the general environmental consequences expected to occur as a result of implementing the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Impacts are discussed generically, because the presence, absence, or location of tribal interests and heritage resources and their relation to potential renewable energy development are not fully known and would be identified through project-specific consultations.

Impacts from the No Action Alternative

Under the No Action Alternative, renewable energy projects would be developed on a case-by-case basis through ROW authorizations and land disposal actions in accordance with the BLM's existing land use plans. Projects would not be directed toward REDAs or other areas evaluated as most suitable for energy development. The types of impacts on tribal heritage resources that could occur would be similar to those described above as renewable energy projects are developed on available BLM-administered land. The number of acres likely to be affected under this alternative is unknown. Compliance with NEPA, NHPA, the Native American Graves Protection and Repatriation Act, and Executive Orders 13007 and 13084 would still be required, reducing the potential for impacts through project siting, efforts to identify and avoid impacts on cultural or natural resources of tribal concern, and efforts to resolve and mitigate adverse impacts. However, the No Action Alternative does not include the additional design features or BMPs as described in **Appendix B**, , Design Features and Best Management Practices, which would give consistent, state-wide guidance for mitigating impacts; mitigation would be determined project-by-project and as needed based on the impact analysis for a specific proposal.

Impacts from Alternative 1

Impacts from Maximum REDA

Under Alternative 1, there would be approximately 321,500 acres of BLM-administered land available for renewable energy ROW application. Existing land use plans would be amended to reflect the goals, management actions, design features, and BMPs of this EIS, but individual field offices could modify these standards in keeping with pre-existing agreements on resource protections to create higher levels of protection and consideration of tribal interests and heritage resources in areas where development is currently governed through land use plan provisions or agreements.

Under Alternative 1, the potential for impacts on tribal interests and heritage resources would be the same as described under Impacts Common to All

Alternatives. Areas with sensitive cultural and natural resources, including ACECs, would be eliminated from REDA. Impacts on tribal interests and resources on most BLM-administered lands would be reduced or avoided through consistent guidance for future renewable energy development, and by avoiding important plant and wildlife species and habitats, rock art sites, springs, and Native American archaeological sites whenever possible (see **Appendix B**, Design Features and Best Management Practices, for a complete listing of requirements). For all lands available, compliance with NHPA, and Executive Orders 13007 and 13084 would be required, reducing the potential for impacts. It is expected that these measures, along with the measures outlined under cultural resources, will minimize impacts on tribal interests and heritage resources. However, there may be residual effects that are difficult or impossible to adequately mitigate, such as permanent loss of some cultural uses or valued qualities of places within traditional tribal territories.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under this alternative, the proposed Agua Caliente SEZ would be 20,600 acres. Malcolm Rogers, an archaeologist who explored western Arizona in the mid-1900s, defined three prehistoric trails that appeared to pass through the area and may have served as travel routes between the Colorado and Gila Rivers. However, their existence has not been verified and their exact location is uncertain (Becker and Altschul 2008). It is possible that other prehistoric sites, such as rock features, camps, or additional trails, are present and were associated with these trails. Archaeological inventories or tribal consultations may result in new information at a later date that would need to be considered in future development. The proposed SEZ is within 10 miles of the Sears Point ACEC, a significant Native American heritage site that many tribes noted of specific concern during consultations. It is possible that there would be visual, aural or atmospheric impacts (as noted in Impacts Common to All Alternatives and **Section 4.2.22**, Visual Resources) to the area should additional development within the proposed SEZ boundaries occur. Implementation of the design features and BMPs for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing these impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, there would be approximately 218,600 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under this alternative, the proposed Agua Caliente SEZ would be 6,770 acres. The impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives; however, the smaller proposed SEZ would likely eliminate portions of the recorded trails and zones likely to contain archaeological sites such as near the mountains, on desert pavement and along major washes. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Alternative 3

Impacts from Load Offset REDA

Under Alternative 3, there would be approximately 129,800 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under this alternative, the proposed Agua Caliente SEZ would be 2,760 acres. The impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives. However, with a smaller footprint, there would be less room to microsite a development should Native American heritage sites be found in the area. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Under Alternative 4, there would be approximately 321,500 acres of BLM-administered land available for renewable energy ROW application. The inclusion of additional water design features in Water Protection Zones 3 and 2 could indirectly result in reducing impacts on water sources Native American tribes consider sacred or culturally important by preventing depletion of spring flows. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed Agua Caliente SEZ would be 20,600 acres. The impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under Alternative 5, there would be approximately 43,700 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
Under Alternative 6, there would be approximately 237,100 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be the same as those described for Alternative 4 and Impacts Common to All Alternatives. The inclusion of additional water design features could indirectly result in reducing impacts on water sources Native American tribes consider sacred or culturally important by preventing depletion of spring flows.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed Agua Caliente SEZ would be 6,770 acres. The impacts would be the same as those described for Impacts Common to All Alternatives and Alternative 2. Implementation of the water resources design features included as part of this alternative, as well as the design features and BMPs for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources, would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

4.2.12 Noise

Evaluation Methodology, Resource Indicators, and Assumptions
The potential effects of renewable energy development on the acoustic environment were evaluated by assessing the effects that anticipated future

actions consistent with the alternatives would have on the areas surrounding such actions. The analysis discusses short-term effects related to construction as well as long-term effects related to operation of wind and solar facilities.

The primary indicator of noise impacts is the introduction of a noise source or sources in an area that is susceptible to changes in the ambient noise environment, such as near residences, schools, hospitals, or recreational areas where quiet is an essential element of the recreational experience.

The following assumptions were used in the impact analysis:

- Design features and BMPs identified in **Appendix B**, Design Features and Best Management Practices, would be implemented for site-specific projects as applicable to the specific project and site location to avoid or minimize construction- and operation-related noise impacts. In particular, the following two measures would be implemented at the planning stage to ensure that solar and wind facilities would not impact sensitive receptors:
 - Project developers shall take measurements to assess the existing background ambient sound levels both within and outside a project site and compare them with the anticipated noise levels associated with a proposed facility. The ambient measurement protocols of all affected land management agencies shall be considered and utilized. Nearby residences and likely sensitive human and wildlife receptor locations shall be identified at this time.
 - Prepare a noise monitoring and mitigation plan. Design a project to minimize noise impacts on sensitive noise receptors, limit increases to less than a 5- to 10-dBA increase above ambient levels, and not exceed local noise standards. Address project-generated noise impacts as much as possible.

Impacts Common to All Alternatives

There would be no direct impacts from the identification of a REDA. Indirect noise impacts associated with renewable energy development include construction-related impacts and operational impacts. Specific impacts associated with constructing and operating solar and wind facilities, including access roads and transmission lines, would depend on the type of technology, the location and scale of a project, and the presence of sensitive noise receptors in a project area. Potential impacts would be assessed on a site-specific basis during the ROW application process. However, a description of the types of noise impacts that would be expected from the construction and operation of renewable energy facilities is provided below.

Solar Energy Development. The Draft Solar PEIS (BLM and DOE 2010) characterizes the types of equipment, associated noise levels, and potential

impacts for each phase of solar facility development, including site characterization, construction, decommissioning/reclamation, and roads and transmission lines (see BLM and DOE 2010, p. 5-204 to 5-214, for a detailed discussion of solar development-related impacts). As described in the Draft Solar PEIS, site characterization generally has negligible emissions except where deep soil coring is required to obtain geotechnical data, well drilling is required for groundwater characterization, or access roads must be developed to reach the site. These activities could generate a substantial, though temporary, amount of noise.

Construction of a solar facility includes a number of operations. As described in the Draft Solar PEIS (see BLM and DOE 2010, p. 5-205), major equipment used during site preparation would include chain saws, chippers, dozers, scrapers, end loaders, trucks, cranes, rock drills, and blasting equipment, if required. Major equipment used in the construction phase would include cranes, end loaders, backhoes, dozers, trucks, and a concrete batch plant if, required. **Table 4-2**, Construction Equipment Noise Levels at 50 Feet, shows the individual noise levels of construction typically used in solar facility construction. Noise levels during construction would depend on the type and level of activity and the number and type of equipment operating at a time.

Construction would generate a measurable, short-term increase in ambient noise levels. The type, location, and level of noise would vary over the course of the construction period. Some phases, such as site preparation, would produce a consistent elevation in ambient noise levels during construction hours, while other operations such as blasting or pile driving would have a more distinct noise profile. The level of impact would depend upon both the noise itself and the distance to sensitive noise receptors in a given project area. In addition to on-site construction noise, commute and truck delivery routes could experience an increase in traffic-related noise. For projects requiring pile driving or rock drilling, ground-borne vibrations could occur.

Noise impacts associated with site-specific actions on BLM-administered lands would be addressed during the ROW application process through the implementation of design features and BMPs such as those contained in **Appendix B**, Design Features and Best Management Practices.

Wind Energy Development. The Wind Energy PEIS characterizes the types of noise impacts that are associated with various phases of wind energy development, including site monitoring and testing; site construction; site access, clearing, and grade alterations; foundation excavations and installations; wind turbine erection; and decommissioning (see BLM 2005b, p. 5-20 to 5-27, for a detailed discussion of wind energy-related impacts).

Table 4-2
Construction Equipment Noise Levels at 50 Feet

Equipment	Noise Level (dBA) 50 feet from Source
Backhoe	78
Blasting	94
Chain Saw	84
Concrete Batch Plant	83
Concrete Mixer Truck	85
Concrete Pump Truck	82
Dozer	82
Crane	85
Drill Rig Truck	79
Dump Truck	76
Excavator	81
Flatbed Truck	74
Front End Loader	79
Generator	82
Grader	83
Pickup Truck	75
Pneumatic Tools	85
Post Driver	72
Rock Drill	81
Roller	85
Scraper	84

Source: U.S. Federal Highway Administration 2006

Similar to solar energy development, wind energy development would produce short-term noise impacts associated with construction equipment usage and with worker commute vehicles and delivery vehicles along transportation routes. The primary noise associated with wind development would be access road construction, blasting for turbine foundations, and wind turbine construction activities requiring the use of heavy equipment. The noise levels would vary between projects and between phases of the same project, depending on such factors as type, model, size, and condition of equipment; operation schedule; and condition of the area being worked. Design features and BMPs identified in **Appendix B**, Design Features and Best Management Practices, could be incorporated into project plans to minimize noise impacts resulting from wind energy development. The specific measures deemed necessary to reduce noise impacts on an acceptable level would be determined during site-specific permitting of individual projects.

Solar Energy Operation. The Draft Solar PEIS describes noise associated with operation of PV and CSP (parabolic trough and power tower) solar facilities

(see BLM and DOE 2010, p. 5-206 to 5-207 for a detailed discussion of operational impacts).

PV solar facilities would have minimal noise associated with operation of the solar field. Noise sources during operation would include inverters, transformers, landscaping equipment, vehicles, and some maintenance activities. Emergency generators and fire water pump engines would also produce noise but would generally only operate during monthly testing.

CSP facilities have similar noise sources as described for PV solar facilities, above. In addition, some CSP technologies (parabolic trough and power tower) would require a power block that would include steam turbine generators, various pumps for circulating water and heat transfer fluids, small-scale boilers to maintain a minimum temperature of fluid during power downtime, and a heat-rejection system such as wet cooling towers or air-cooled condensers. The Draft Solar PEIS (BLM and DOE 2010) identifies cooling towers as the greatest source of noise within a power block.

Design features and BMPs described in **Appendix B**, Design Features and Best Management Practices, include siting noise-generating equipment such that noise levels are attenuated at site boundaries and nearby sensitive receptors. Potential impacts would be assessed on a site-specific basis during the ROW application process, and specific measures would be identified to avoid or minimize noise impacts.

Wind Energy Operation. Operational noise impacts associated with wind energy facilities are described in detail in the Wind Energy PEIS (BLM 2005b, p.5-22 to 5-26). Noise sources identified include mechanical and aerodynamic noise, landscaping equipment, vehicles, and some maintenance activities. Emergency generators and fire water pump engines would also produce noise but would generally only operate during monthly testing.

Wind turbines would produce mechanical noise and aerodynamic noise, with aerodynamic noise being the dominant noise source from newer wind turbines. Mechanical noise would be produced by the gearbox, generators, yaw drives, and cooling fans. The hub, rotor, and turbine could amplify the noise, however, transmitting the sound over a greater distance (BLM 2005b, p. 5-23). Aerodynamic noise would originate from the flow of air over and past the blade of the turbine. This noise, which cannot be avoided, would produce a pulsing (whooshing) sound. The actual noise produced by wind turbine operation would depend on a number of factors, including the type of wind turbine, the configuration of the turbines, the speed at which the turbine was operating, and atmospheric conditions. The Wind Energy PEIS estimated a sound pressure level of 58 to 62 dBA at 164 feet from the turbine, with turbines attenuating to background levels approximately 2,000 feet from the wind turbine. The level of impact of a wind facility would depend upon existing ambient noise levels at a project site as well as the presence of noise-sensitive land uses in the

surrounding area. Please refer to the Wind Energy PEIS for a detailed discussion of wind turbine-related noise.

In addition to the wind turbines, switchgear and transformers would be sources of operational noise. Potential impacts would be assessed on a site-specific basis during the ROW application process, and specific measures would be identified to avoid or minimize noise impacts.

Transmission-Related Noise. Wind and solar facilities would require the ability to deliver generated power to the grid. Noise related to the delivery of power would include potential corona discharge from transmission lines. Corona discharge is the electrical breakdown of air into charged particles and can produce a crackling or hissing noise as well as a humming noise. Corona noise is affected by weather and by altitude and temperature. It occurs when air ionizes near irregularities on the conductor surface of operating transmission lines. During dry conditions, modern transmission lines produce a limited amount of noise. During wet conditions, however, water drops on the lines provide favorable conditions for corona discharge (BLM 2005b, p. 5-26). Given the arid climate of the planning area, corona noise impacts would be limited.

Decommissioning and reclamation would have impacts similar to those described for construction for both solar and wind facilities, and measures to minimize impacts would likely be similar to those described in **Appendix B**, Design Features and Best Management Practices.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Solar and wind development would occur at its current pace. Projects would have short-term and localized noise impacts at the project sites, along area roadways, and along new transmission or generation tie-in routes during construction. Operational impacts would depend upon the presence of sensitive receptors near proposed project sites. No standard list of design features and BMPs would be in place to avoid or mitigate noise impacts; however, permitting for individual projects would require analysis and mitigation of short-term and long-term impacts. These impacts are discussed under Impacts Common to All Alternatives.

Impacts from Alternative 1

Impacts from Maximum REDA

The nature and type of noise impacts would be the same as those described for Impacts Common to All Alternatives. Because this alternative provides the most land area, this alternative has the most flexibility for siting renewable energy projects, both in terms of location and technology. Operational impacts would depend upon the presence of sensitive receptors near proposed project sites. Design features and BMPs shown in **Appendix B**, Design Features and Best Management Practices, would require that individual projects avoid or mitigate noise impacts on sensitive land uses in a project area.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of noise impacts would be the same as those described for PV and CSP solar developments under Impacts Common to All Alternatives. From a review of aerial photography and field visits to the site, no sensitive receptors (e.g., hospitals, schools, or nursing homes) appear to exist within one mile of the proposed Agua Caliente SEZ. The nearest obvious residence to the proposed SEZ boundary is about 1.5 miles to the northeast of the northeastern corner. Given the lack of sensitive receptors in the planning area, short-term and long-term noise impacts would be expected to be minimal. Short-term noise impacts may occur if access roads or transmission line routes occur near residences; given the linear nature of these features, the duration of construction in any one location would be short. Design features and BMPs described in **Appendix B**, Design Features and Best Management Practices, would be required to minimize noise impacts for projects within the proposed SEZ.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of noise impacts would be the same as those described for Impacts Common to All Alternatives. Because the REDA under this alternative only include lands within five miles of existing or certified transmission lines and utility corridors, the distance to connect the proposed developments to transmission would be minimized, reducing construction-related noise impacts associated with transmission line construction as compared with Alternative 1. Measures to minimize noise impacts would be the same as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Noise impacts would be the same as described for Alternative 1, though Alternative 2 contains a smaller proposed SEZ footprint and would likely result in a lesser amount of development within the proposed SEZ. Given the lack of sensitive receptors within one mile of the proposed SEZ, impacts would be expected to be minimal.

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and type of noise impacts would be the same as those described for Impacts Common to All Alternatives. Limiting development to within 10 miles of load centers could encourage development closer to populated areas, resulting in potential short-term noise impacts on sensitive receptors if such receptors were located adjacent to construction activities. However, measures to minimize noise impacts would be implemented to reduce noise and ensure that noise standards at property boundaries were being met. These measures would be similar to those described for Alternative 1. Because this alternative encourages development near load centers, there is the potential that this alternative would favor PV over CSP technologies or smaller wind turbines over

larger turbines. To the extent that this occurred, operational noise impacts may be reduced under this alternative.

Impacts from Proposed Agua Caliente Solar Energy Zone
Noise impacts would be similar to those described for Alternative 1. Alternative 3 contains the smallest proposed SEZ footprint and would likely result in the least amount of development within the proposed SEZ and thus would introduce the least amount of noise-generating activities. Given the lack of sensitive receptors within one mile of the proposed SEZ, impacts would be expected to be minimal.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
The nature and type of noise impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 4 includes the same land area as Alternative 1 but would limit technologies in water resource protection zones to dry-cooling technology. Prohibiting wet cooling may encourage PV solar over other solar technologies, slightly reducing potential operational-related noise emissions associated with power block equipment. Measures to minimize noise impacts would be the same as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone
Noise impacts would be the same as described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
The nature and type noise impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 5 would emphasize land exchanges for renewable energy development, resulting in less development on BLM-administered land. Measures to minimize noise impacts would be the same as described for Alternative 1.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
The nature and type of noise impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 6 would place renewable energy development near transmission and load centers while maintaining the water protection zones described for Alternative 4. Impacts would be similar to Alternative 2 in the size of the potential development area, similar to Alternative 3 in the potential effects to sensitive receptors close to load centers, and similar to Alternative 4 in prohibiting wet-cooling technology . Measures to minimize noise impacts would be the same as described for these alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Noise impacts would be the same as described for Alternative 2.

4.2.13 Paleontological Resources

Evaluation Methodology, Resource Indicators, and Assumptions

Sensitivity levels were determined based on the PFYC system used by the BLM. Literature research, institutional record searches, and the PFYC provided the information necessary to assign a sensitivity level of high, low, or moderate/undetermined to the planning area. Any future provisions for mitigation of adverse impacts on significant paleontological resources exposed during construction-related activities are based upon these determinations of sensitivity level. The terms "high sensitivity level," "moderate/undetermined sensitivity level," and "low sensitivity level" are defined in **Section 3.13**, Paleontological Resources.

The alternatives give variations in acreages of geological units with PFYC levels 3, 4, and 5 (moderate/undetermined to high sensitivity) that could be impacted by ground-disturbing activities during construction. Geological units within the REDAs have been assigned to one of the five PFYC levels, with PFYC level 3, Moderate/Undetermined potential for containing paleontological resources, being most common.

The RFDS (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona) assumes that in order for Arizona to meet its goal of 15 percent renewable electrical generation by 2025, 12,000 and 3,600 acres of BLM-administered lands would be required for solar and wind energy generation facilities, respectively. Solar energy facilities occupy smaller project areas than wind facilities, but are assumed to disturb 100 percent of a project area, whereas wind energy facilities occupy larger project areas, but are assumed to disturb only 10 percent of a project area. Therefore, 12,000 and 360 acres of BLM-administered lands would be disturbed for solar and wind energy generation facilities, respectively. There are negligible differences in ground-disturbance requirements between the various viable utility-scale solar technologies.

The primary concern regarding impacts on paleontological resources is the loss of scientifically significant fossils and their contextual data. Impacts on paleontological resources would result from implementing the planning decisions.

An impact on paleontological resources is considered potentially significant and, therefore, an indicator if it would result in a loss of or inaccessibility to scientifically significant paleontological resources. The primary concern regarding impacts on paleontological resources is that direct damage to or destruction of fossils would result in the loss of important scientific information. It is possible that ground disturbance, such as grading, could encounter important paleontological resources. In addition, other potential impacts associated with construction activities are a concern. For example, fossils could

be subject to damage or destruction by erosion accelerated by construction disturbance. Improved access and increased visibility as a result of construction could cause fossils to be damaged, destroyed, or collected as a result of unauthorized collection or vandalism. Excavation often reveals significant fossils that would otherwise remain buried and unavailable for scientific study. Such fossils can be collected properly and catalogued into the collection of a museum repository so that they can be available for scientific study.

The following assumptions were made to conduct the impacts analysis:

- Future projects on BLM-administered lands would be required to inventory, assess, and mitigate potential impacts on paleontological resources.
- The creation and implementation of a Paleontological Resource Management Plan that will include mitigation measures such as avoidance, removal of fossils (data recovery), stabilization, monitoring, protective barriers and signs, and other physical or administrative protection measures would properly reduce impacts on paleontological resource to negligible levels. Furthermore, this would properly preserve the scientific information inherent to paleontological resources.

Impacts Common to All Alternatives

The potential for impacts on paleontological resources from renewable energy development, including ancillary facilities such as access roads and transmission lines, is directly related to the location of a project regardless of the technology employed. Other effects, such as impacts resulting from the erosion of disturbed land surfaces and from increased accessibility to possible site locations, are also considered.

Impacts on paleontological resources could result as follows:

- Complete destruction of the resource and loss of valuable scientific information could result from the clearing, grading, and excavation of a project area and from construction of facilities and associated infrastructure if paleontological resources are located within the development area.
- Degradation and/or destruction of near-surface paleontological resources and their stratigraphic context could result from the alteration of topography; alteration of hydrologic patterns; removal of soils; erosion of soils; and runoff into and sedimentation of adjacent areas if near-surface paleontological resources are located on or near a project area. Such degradation could occur both within a project footprint and in areas downslope or downstream. While the erosion of soils could negatively affect near-surface paleontological localities downstream of a project area by

potentially eroding materials and portions of sites, the accumulation of sediment could serve to remove from scientific access, but otherwise protect, some localities by increasing the amount of protective cover. Agents of erosion and sedimentation include wind, water, downslope movements, and both human and wildlife activities.

- Increases in human access and subsequent disturbance (e.g., looting and vandalism) of near-surface paleontological resources could result from the establishment of corridors or facilities in otherwise intact and inaccessible areas. Increased human access (including OHV use) exposes paleontological sites to a greater probability of impact from a variety of stressors.

Paleontological resources are nonrenewable and, once damaged or destroyed, cannot be recovered. Therefore, if a paleontological resource (specimen, assemblage, or site) is damaged or destroyed during renewable energy development, this scientific resource would become irretrievable. Data recovery and resource removal are ways in which at least some information can be salvaged should a paleontological site be affected, but certain contextual data would be invariably lost. The discovery of otherwise unknown fossils would contribute to the scientific record and the public good, but only as long as sufficient data can be recorded.

Impacts from the No Action Alternative

Under the No Action Alternative, renewable energy projects would still be developed through ROW authorizations in accordance with the BLM's existing lands and realty policies. Impacts on paleontological resources would be of the types described above, with mitigation measures being included on a case-by-case basis. Any additional design features or required BMPs would be determined from the existing land use plan where a future project is proposed. Paleontological resources would not be impacted in areas excluded from development such as national monuments, national conservation areas, and wilderness areas.

Impacts from Alternative 1

Impacts from Maximum REDA

The types of impacts resulting from implementation of the planning decisions under Alternative 1 are described under Impacts Common to All Alternatives. Under Alternative 1, there are 137,900 acres of BLM-administered land with geological units assigned to PFYC levels 3, 4, or 5 (Moderate/Undetermined to High Sensitivity). The alternative contains management actions (described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario), and design features and BMPs (described in **Appendix B**) that would reduce the likelihood and severity of the noted types of impacts. The application of these measures would reduce or eliminate the potential for adverse impacts on significant paleontological resources. If avoidance is chosen

as the preferred mitigation measure, projects could be located, designed, or modified to avoid impacts on significant resources. An additional mitigation measure that would reduce impacts related to vandalism or increased human presence in an area would include the use of training/education programs to reduce the amount of inadvertent destruction to paleontological sites; this could reduce the occurrences of human-related disturbances to nearby sites (summarized in **Table 4-35**, Additional Mitigation Measures, at the end of this chapter). The specifics of these management practices would be established in project-specific coordination between the project developer and the BLM.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 1, the proposed Agua Caliente SEZ contains 4,070 acres with geological units assigned to PFYC level 3; there are no PFYC level 4 or 5 units within the proposed SEZ. A more detailed investigation of the alluvial deposits as well as the residual materials, especially where Tertiary units are shallow or exposed, is recommended prior to a project being approved. A paleontological survey may be needed following consultation with the BLM, following the guidance in BLM IM2008-009 and IM2009-011. The types of impacts that could occur on any significant paleontological resources found within the proposed SEZ are the same as those described above. Impacts would be reduced through the implementation of required programmatic design features described in **Appendix B**, Design Features and Best Management Practices.

Indirect impacts on paleontological resources outside of the proposed SEZ, such as through looting or vandalism, are unknown but possible if any such resources are at or near the surface. Programmatic design features for controlling water runoff and sedimentation would prevent erosion-related impacts on buried deposits outside of the proposed SEZ. Applying the same training/education programs as described above would reduce the amount of inadvertent destruction to paleontological sites and could reduce the occurrences of human-related disturbances to nearby sites.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, the impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives, except that it includes 58,400 acres with geological units assigned to PFYC levels 3, 4, or 5 (Moderate/Undetermined to High Sensitivity). Applying the management actions, design features, BMPs, and additional suggested mitigation for training/education programs would reduce impacts as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 2, the proposed Agua Caliente SEZ impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives, except that it includes 490 acres with geological units assigned to PFYC level 3. No formations have been assigned to PFYC level 4 or 5. The

results of applying the management actions, design features, and BMPs would be the same as those described for Alternative 1. Including the mitigation measures for training/ education programs as noted in Alternative 1 would further reduce impacts on any nearby paleontological sites from human-related disturbance.

Impacts from Alternative 3

Impacts from Load Offset REDA

Under Alternative 3, the impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives, except that it includes 41,300 acres with geological units assigned to PFYC levels 3, 4, or 5. Applying the management actions, design features, BMPs, and additional suggested mitigation for training/education programs would reduce impacts as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 3, the proposed Agua Caliente SEZ contains 10 acres with geological units assigned to PFYC level 3; there are no PFYC level 4 or 5 units within the proposed SEZ. The results of applying the management actions, design features, and BMPs would be the same as those described under Alternative 1. Including the mitigation measures for training/education programs as noted in Alternative 1 would further reduce impacts on any nearby paleontological sites from human-related disturbance.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Under Alternative 4, the impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives, except that it would affect 63,000, 54,600, and 10,500 acres of BLM-administered lands with geological units assigned to PFYC levels 3, 4, or 5 for Water Protection Zones 1, 2, and 3, respectively (Moderate/Undetermined to High Sensitivity). Applying the management actions, design features, BMPs, and additional suggested mitigation for training/education programs would reduce impacts as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 4, the size of the proposed Agua Caliente SEZ and associated impacts would be the same as those that would occur under Alternative 1, as described above. The results of applying the management actions, design features, and BMPs as described in Alternative 3 would be the same as those described under Alternative 1. Including the mitigation measures for training/education programs (as noted in Alternative 1) would further reduce impacts on any nearby paleontological sites from human-related disturbance.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Under Alternative 5, the impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives, except that it includes

7,900 acres with geological units assigned to PFYC levels 3, 4, or 5. Applying the management actions, design features, BMPs, and additional suggested mitigation for training/education programs would reduce impacts as described for Alternative 1.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Under Alternative 6, the impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives, except that it includes 18,800, 32,200, and 10,500 acres of BLM-administered lands with geological units assigned to PFYC levels 3, 4, or 5 for Water Protection Zones 1, 2, and 3, respectively (Moderate/Undetermined to High Sensitivity). Applying the management actions, design features, BMPs, and additional suggested mitigation for training/education programs would reduce impacts as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 6, the size of the proposed Agua Caliente SEZ and associated impacts would be the same as those that would occur under Alternative 2, as described above. The results of applying the management actions, design features, and BMPs would be the same as those described under Alternative 2. Including the mitigation measures for training/education programs as noted in Alternative 2 would further reduce impacts on any nearby paleontological sites from human-related disturbance.

Additional Mitigation Measures

The use of training/education programs to reduce the amount of inadvertent destruction on paleontological sites could reduce the occurrences of human-related disturbances to nearby sites. The specifics of these management practices would be established in project-specific coordination between the project developer and the BLM.

4.2.14 Public Health and Safety

Evaluation Methodology, Resource Indicators, and Assumptions

Potential effects of solar and wind development on public health and safety were evaluated by examining the typical hazards associated with all phases of such development, as described in **Section 3.14**, Public Health and Safety, and discussing the likelihood of those effects occurring within the REDA and the various proposed Agua Caliente SEZs.

Potential impacts on health and safety could occur if reasonably foreseeable future actions were to result in the following:

- Create a hazard to workers or the public through the routine transport, use, or disposal of hazardous materials;

- Create a hazard to workers or the public through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- Emit hazardous emissions or result in handling of hazardous or acutely hazardous materials, substances, or waste within 0.25-mile of an existing or proposed school; or
- Be located on a site that is included on a list of hazardous materials sites compiled by the federal or state government and, as a result, would create a hazard to workers or the public.

The following assumptions were used in the impact analysis:

- Occupational Safety and Health Administration health and safety guidelines would be followed by all workers during all construction, operation, and decommissioning phases of all projects.
- Construction areas would be fenced to exclude public entry.
- Design features and BMPs identified in **Appendix B** would be implemented for all renewable energy projects.

Impacts Common to All Alternatives

There would be no direct impacts from the identification of a REDA. Indirect impacts on public health and safety would result from implementing the planning decisions and possible future ground-disturbing activities associated with construction of renewable energy facilities.

Solar Energy Developments

Health and safety risks to the general public can include physical hazards from unauthorized access to construction or operational areas of solar facilities; increased risk of traffic accidents in the vicinity of solar facilities; risk of eye damage from glare from mirrors, heliostats, and power tower receivers; and aviation safety interference. Because of the remote nature of most solar facilities, the health and safety risks are generally low but would be addressed in facility health and safety plans.

Risks from public exposure to hazardous substances through air emissions from solar facilities are low, because the few substances that are stored and used at the facilities in large quantities have low volatility and inhalation toxicity. Small quantities of combustion-related hazardous substances may be emitted from diesel-burning construction equipment. In addition, during operations there may be emissions of similar contaminants from steam boilers using natural gas or coal as an energy source at certain times. Because these would be supplemental boilers using small amounts of fuel, however, emissions and corresponding health risks are likely to be small. Nevertheless, the health risks of such emissions should be evaluated at the project-specific level.

Electrically energized equipment and conductors associated with solar facilities and the transmission lines that serve them represent electrical hazards. Proper signage or engineered barriers (e.g., fencing) would be necessary to prevent access to these electrical hazards by unauthorized individuals.

Public exposures to magnetic fields associated with solar facilities would be expected to be negligible because setback zones would require homes and occupied buildings to be located well away from solar facilities and transmission lines.

Wind Energy Developments
Potential public safety hazards during the site monitoring and testing phases are minimal. During construction, operation, and decommissioning of a wind energy development project, the hazards are greater but they can be effectively mitigated. These hazards include risks associated with major construction sites, rare tower failures, human-caused fire, EMF exposure, aviation safety interference, EMI, low-frequency sound, and shadow flicker.

Impacts from the No Action Alternative
All of the risks identified in **Section 3.14**, Public Health and Safety, would apply under the No Action Alternative. Solar and wind energy project applications would be submitted to the BLM from energy developers based on resource availability, economics, and site suitability. Given the impact analysis assumptions, these impacts would be similar to the risks associated with any other kind of construction projects. Impacts under the No Action Alternative are expected to be negligible.

Impacts from Alternative 1
Impacts from Maximum REDA
Under this alternative, the types of impact would be the same as described under Impacts Common to All Alternatives.

The development of low sensitivity lands, including some lands that have been previously disturbed and contain varying levels of contamination, may result in the cleanup and securing of contaminated lands that would otherwise be open to the public and could be sources of possible exposure to hazardous substances.

Implementation of this alternative would amend the BLM land use plans identified in **Section 1.5.1**, Decisions on the REDA, to require, as deemed appropriate by the BLM authorized officer for individual renewable project applications, the following plans:

- Dust Abatement Plan;
- Facility Vector Control Plan;
- Fire Management and Protection Plan;

- Hazardous Materials and Waste Management Plan;
- Health and Safety Program;
- Integrated Pest Management Plan;
- Noise Monitoring and Mitigation Plan; and
- Spill Prevention and Emergency Response Plan.

Implementation of these plans would address precautions and response actions related to various health and safety concerns for both workers and the public, such as the release of hazardous materials into the environment. Based on implementation of these management actions, design features, and BMPs, impacts are expected to be negligible.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the types of impacts would be as described under Impacts Common to All Alternatives. Unexploded ordnance could pose a risk of explosion during ground-disturbing operations, which could result in injury or death of construction workers. Strategies to address the possible presence of unexploded ordnance would be developed as part of a Hazardous Materials Management Plan that would be prepared by the project proponent of any project proposed in the SEZ.

Based on implementation of the management actions, design features, and BMPs described as part of this alternative, impacts are expected to be negligible.

Impacts from Alternative 2
Impacts from Transmission Line and Utility Corridor REDA
Under this alternative, the types of impact would be the same as described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
Under this alternative, the types of impact would be the same as described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Under this alternative, the types of impact would be the same as described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under this alternative, the types of impact would be the same as described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
Under this alternative, the types of impact would be the same as described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

4.2.15 Recreation

Evaluation Methodology, Resource Indicators, and Assumptions
Special Recreation Management Areas have been identified as "Areas with Known Sensitive Resources" (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]). As such, these lands have been eliminated from consideration as a REDA. In addition, some non-BLM-administered lands that provide valuable recreational opportunities and experiences, including wilderness and national monuments managed by other agencies, national parks, and others, are also eliminated from the REDA.

Potential impacts on recreation could occur if reasonably foreseeable future actions were to result in the following:

- Result in long-term elimination or reduction of recreation opportunities, activities, or experiences;
- Conflict with recreation management objectives for the area; or
- Result in proposed land uses that are incompatible with existing or adjacent recreational opportunities or experiences.

Impacts Common to All Alternatives
Because utility- and community-scale solar energy development sites are usually fenced and off-limits to the public, they directly impact recreation through loss of land available for recreational activities. Indirect impacts include degradation of the recreational setting characteristics and increased access through the construction of new or improved roads that may be integrated with local trail and road systems used for hiking, OHV riding, and other recreational activities. However, visitors looking for a remote and undisturbed recreational experience may decide to go elsewhere.

Wind energy development can result in similar direct impacts, although limited on-site recreational access may be allowed because many sites are not fenced. Indirect impacts also include site characteristics degradation and improved access and connectivity.

Excluding SRMAs and other areas important for recreation would limit impacts under all alternatives.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind energy development applications would continue to be processed on a case-by-case basis. Without a coordinated, programmatic approach, SRMAs and the user benefits they provide would be vulnerable to impacts such as degradation of the physical setting characteristics and loss of land to development. Where development occurs, access would also improve, making less-visited recreation areas and destinations more accessible.

Impacts from Alternative 1

Impacts from Maximum REDA

Recreation would experience the most widespread impacts under Alternative 1. With 321,500 acres available for renewable energy development, there would be greater potential for conflict with recreational opportunities and experiences. Impacts would be mitigated through avoidance of areas with unique or important recreation resources and by the potential replacement of lost OHV access. As a result, popular recreation areas would most likely remain free of renewable energy development, and OHV enthusiasts could potentially retain access to the same number of miles of trails and roads. There would still be potential for impacts if replacement access were not of similar quality or if nonmotorized trails were located in an area slated for development (the BMP regarding replacement of lost access pertains to OHV use only).

Impacts from Proposed Agua Caliente Solar Energy Zone

Locating renewable energy development in 20,600 acres currently managed as an SRMA would result in the direct, long-term loss of recreational opportunities and experiences. Activities that would be impacted include those dispersed activities for which the SRMA is managed, including hunting and OHV riding. Hunting especially is popular on BLM-administered portions of the proposed SEZ; if development were to occur in or near that portion, opportunities would be lost. As a result of any development in the proposed SEZ, recreationists would have to go elsewhere in the SRMA or decision area to attain benefits similar to those offered by the developed area.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Because the 218,600-acre REDA would be located exclusively in close proximity to transmission lines and utility corridors, development would be concentrated in a smaller area. As a result, fewer acres would likely be developed and the

potential for conflict with recreation sites and areas would be decreased. However, the smaller REDA could force development to become more concentrated, meaning its impacts on nearby recreation resources could be amplified.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed SEZ would cover 6,770 acres and would not include the northern portion of the proposed SEZ under Alternative 1. As a result, fewer acres of hunting opportunities would be impacted, although noise, vehicles, and other disturbances during construction and, to a lesser extent, operation could drive animals away, degrading the hunting experience.

Impacts from Alternative 3
Impacts from Load Offset REDA
The types of impacts would be similar to those described under Impacts Common to All Alternative, but by concentrating the 129,800-acre REDA in areas close to towns, cities, and other load centers, impacts on developed recreation would be more likely than those to dispersed recreation, which typically occurs in middle- or backcountry settings.

Impacts from Proposed Agua Caliente Solar Energy Zone
The proposed SEZ would cover only 2,760 acres, the smallest area of any alternatives, thereby reducing impacts on recreation. In addition, popular hunting access provided in the area north of the proposed SEZ would be preserved, limiting impacts on hunting in a manner similar to that described under Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
The types of impacts under Alternative 4 would be similar to those described under Alternative 1, occurring over 321,500 acres. Designing the REDA around water conservation features would have a negligible impact on recreation.

Impacts from Proposed Agua Caliente Solar Energy Zone
The types of impacts on recreation from the proposed SEZ under Alternative 4 would be similar to those described under Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under Alternative 5, the REDA would be composed of 43,700 acres identified for disposal in existing RMPs, which does not include areas highly valued for their recreational resources. As a result, impacts on recreation would be negligible.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Locating the 237,100-acre REDA near load centers would likely reduce impacts on primitive or backcountry recreation at the expense of day-use recreation areas, which are more typically located front country near the urban interface. This, along with limiting development to utility corridors and in close proximity to transmission lines, would likely concentrate development in a smaller area, meaning impacts on adjacent recreation areas would be magnified. However, avoiding areas with unique or valuable recreation resources would minimize impacts. Incorporating water conservation features similar to those under Alternative 3 would have no impact on recreation.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed SEZ under Alternative 6 would be the same size and location as under Alternative 2. Therefore, impacts would be similar.

4.2.16 Socioeconomics

Evaluation Methodology, Resource Indicators, and Assumptions

The specific impacts of development of solar and wind energy facilities on social and economic conditions would depend on project location, technology and scale employed, size of the development, and proximity to existing communities. Analysis for jobs is provided on the basis of the assumptions given in the project RFDS (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona). However, due to the uncertainty of specific solar and wind development that would occur as a result of identifying lands within the REDA as available for solar and wind energy development, quantitative community-level impacts cannot be conducted. Qualitative analysis is provided for tax revenue, property value change, socioeconomic impacts due to changes in other land uses, non-market value, and social indicators. Implementation-level actions (development of specific solar and wind facilities) would be subject to further environmental review and would include quantifying impacts affected by site-specific development.

Potential impacts on social and economic conditions could occur if anticipated future actions described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, were to alter the following:

- Employment and income at the personal, household, business, or community level;
- Tax revenues (sales and state income);
- Property values; or
- Other land uses which provide social or economic benefits to the local community or region.

Social indicators are those related to the value of sense of place and sense of well-being, including factors such as people's interaction with the landscape; community perceptions of quality of life; attitudes and beliefs regarding the local environment, its uses, and sense of place; and limiting or expanding community growth.

This analysis assumes the following:

- Visitor use and demand for use of public land for recreation purposes is expected to increase as population increases. Increased visitation would have economic impacts on communities that serve as stopping points for services near public lands.
- Management actions that influence employment, demand for goods and services, business growth, and visitation will affect socioeconomics. Impacts will most greatly be felt in small rural communities that economically and socially rely, at least partially, on resource uses on public lands, including vegetation products, lands and realty, livestock grazing, minerals, recreation, and travel.
- Landowners may be willing to sell or lease land for renewable energy.
- Actions that increase renewable energy production will tend to stimulate the local and regional economies, both through increased employment and demand for goods and services for the operation itself. The duration of this effect will depend upon the magnitude of energy production and market demand for the products.

Impacts Common to All Alternatives

Due to the inability to predict future development scenarios, including types of technology, scale, timing, and location, the following impact analysis provides a general description of common impacts on socioeconomics from solar and wind development. The specific location of development and community-specific impacts would be determined in subsequent NEPA analysis prior to development. Impacts common to energy development include, but are not limited to, effects on jobs, population growth, property taxes, changes to tourism and recreation, and changes to the social community and quality of life. A comparison of the impacts of renewable energy development with oil and gas development impacts is **Table 4-3**, Comparison of Socioeconomic Effects in the Oil and Gas, Wind Energy, and Solar Energy Industries.

Impacts on Employment

Impacts on social and economic conditions include the creation of jobs related to renewable energy plant construction and operations, such as jobs directly created at plants and those indirectly created through the increase in local economic spending. Workers necessary for construction and operations and

Table 4-3
Comparison of Socioeconomic Effects in the Oil and Gas, Wind Energy, and Solar Energy Industries

	Oil and Gas	Wind	Solar
Job Creation	+ +	Negligible	Negligible
Population Growth	−−	Negligible	Negligible
Lease Payments	+	+	+/−
Property Taxes	+	+ +	Negligible
Tourism	NA	+/−	+/−
Recreation	NA	+/−	+/−
Quality of Life	NA	+/−	+/−
Social Cohesion	NA	+/−	+/−

Source: Fernandes et al. 2010
A "+" indicates a benefit while a "−" indicates a cost. A "+/−" indicates the effect could be a cost or benefit and a double symbol indicates a significant effect.

maintenance activities are direct sources of job creation. Indirect and long-term job creation for renewable energies is more abstract and can be influenced by many factors, including future prices for both conventional fuel and renewable energy (Singh et al. 2001).

Jobs can be estimated per MW based on estimated labor demands. To calculate impacts, representative data from a range of renewable energy development projects in the western U.S. were used. **Table 4-4**, Comparison of Projected Employment Impacts for Solar Development, takes job projections from final NEPA and California Environmental Quality Act documents, project fact sheets, or similar sources to provide an estimate of jobs per MW produced. In general, PV projects tend to be less labor-intensive, as peak construction jobs range from a low of 0.52 job per MW to a high of 1.38 jobs per MW, and operations and maintenance jobs range from a low of 0.05 job per MW to a high of 0.09 job per MW. CSP projects tend to be more labor intensive, as construction jobs range from a low of 0.60 job per MW to a high of 5.47 jobs per MW, and operations and maintenance jobs range from a low of 0.05 job per MW to a high of 0.47 job per MW. As an average, the solar technologies provide a low of 0.60 job per MW to a high of 1.38 jobs per MW for construction (average 1.90) and a range of 0.05 to 0.47 job per MW for operations and maintenance (average 0.20). Based on the solar RFDS (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona), development in the planning area can be expected to result in a generating capacity of 9,500 MW, including 1,500 MW on BLM-administered lands by 2025. Using the estimates provided above, the projections for BLM-administered lands include a low of 900 jobs to a high of 2,070 jobs for construction (average 2,850) and 75 to 705 for operations and maintenance (average 293).

Table 4-4
Comparison of Projected Employment Impacts for Solar Development

Project Name	Technology	MW	Construction Jobs (Peak)	Construction Jobs/MW	O&M Jobs	O&M Jobs/MW
Agua Caliente*	PV	290	275	0.95	18	0.06
Lucerne Valley Solar Project	PV	45	45	1.00	3	0.07
Solar Ranch One	PV	230	300	1.30	20	0.09
Abengoa Mojave Solar Project	CSP	250	1,162	4.65	68	0.27
Beacon Solar Energy Project	CSP	250	836	3.34	66	0.26
Calico Solar Project (Formerly SES Solar One Project)*	CSP	663.5	400	0.60	136	0.20
Crescent Dunes Solar Energy Project*	CSP	110	475	4.31	50	0.45
Genesis Solar*	CSP	250	646	2.58	65	0.26
Imperial Valley Solar Project (Formerly SES Solar Two Project)	CSP	750	731	0.97	164	0.22
Nevada Solar One*	CSP	64-70	350	5.00-5.47	30	0.43-0.47
Rice Solar Energy Project	CSP	150	438	2.92	47	0.31
Solar Millennium Blythe*	CSP**	1,000	1,004	1.00	221	0.22
Solar Millennium Palen*	CSP	500	1,145	2.29	134	0.27
Solar Millennium Ridgecrest	CSP	250	633	2.53	84	0.34
Solar Partners Ivanpah Solar Electric Generating System*	CSP	370	959	2.59	90	0.24
Technology averages			Construction Jobs/MW		O&M Job/MW	
Average CSP			Range 0.60-5.47 Average 1.08		Range 0.05-0.47 Average 0.07	
Average PV			Range 0.52-1.38 Average 2.73		Range 0.05-0.09 Average 0.32	
Average solar			Range 0.60-1.38 Average 1.90		Range 0.05-0.47 Average 0.20	

Source: Fernandes et al. 2010; DOE 2010 (Agua Caliente); BLM 2010d (Calico Solar Project); BLM 2010e (Crescent Dunes Solar Energy Project); BLM 2010f (Genesis Solar); National Renewable Energy Lab 2011 (Nevada Solar One); California Energy Commission 2010a (Solar Millennium Blythe); California Energy Commission 2010b (Solar Millennium Palen); California Energy Commission 2010c (Solar Millennium Ridgecrest); California Energy Commission 2010d (Solar Partners Ivanpah Solar Electric Generating System).

* Note that some jobs/MW figures are higher because for some projects, construction and/or operations and maintenance is calculated in phases, meaning that there would be waives of hires for certain labor needs. Numbers given are projected numbers, regardless of whether or not the project has begun construction or finished construction. For projects with a range provided an average was selected for this analysis.

** The Solar Millennium Blythe Project has been changed from CSP to at least 50 percent PV technology (Kaufmann 2011). The original jobs/MW analysis is sourced from California Energy Commission 2010a.

*** O&M = operations and maintenance

Table 4-5, Comparison of Projected Employment Impacts for Wind Energy, examines the jobs per MW during the construction and operations and maintenance phases of utility-scale wind projects. The table uses data from environmental reports and project profile fact sheets of wind projects as well as summary data from a recent National Renewable Energy Lab study in order to assess the typical impacts of wind projects on job creation. Wind projects tend to be less labor intensive both for construction and for operations and maintenance activities than similarly sized solar projects (particularly CSP projects). For wind, peak construction jobs range from a low of 0.75 job per MW to a high of 3.17 jobs per MW and operations and maintenance jobs range from a low of 0.05 job per MW to a high of 0.15 job per MW. Other job estimates per MW of wind power vary. According to an National Renewable Energy Lab study, wind power projects produce 40 to 140 jobs during construction per 100 MW (and less than this for new projects), and 6 to 20 permanent operations and maintenance jobs per 100 MW (average of 10 jobs per 100 MW), This means that during the construction phase, there is, on average, 0.4 to 1.4 jobs per MW, and during the operations and maintenance phase there is, on average, 0.06 to 0.20 job per MW (Flowers 2005).

Table 4-5
Comparison of Projected Employment Impacts for Wind Development

Project Name	MW	Construction Jobs (peak)	Construction Jobs/MW	O&M Jobs	O&M Jobs/MW
Granite Mountain Wind	58.8-88.4	80-100	0.90-1.70	5-8	0.06-0.14
China Mountain Wind	425	396	0.93	34	0.09
Tule Wind Project	200	150	0.75	10	0.05
Dry Lake Wind Project	63	200	3.17	5-10	0.08-0.15
Twin Buttes Wind Project	75	100	1.33	5-6	0.07-0.08
National Renewable Energy Lab study	100	40-140	0.40-1.40	6-20	0.06-0.20
Average Jobs/MW			Range 0.40-3.75 Average 1.32		Range 0.05-0.20 Average 0.09

Sources: BLM 2010h (Granite Mountain Wind); BLM 2011c (China Mountain Wind); Iberdola Renewables 2008 (Tule Lake Wind Project); Iberdola Renewables 2010a (Dry Lake Wind Project); Iberdola Renewables 2010b (Twin Buttes Wind Power Project).
Note that for consistency, in all of the above projects, the numbers given are projected numbers, regardless of whether or not the project has begun construction or finished construction.
* O&M = operations and maintenance

Based on the wind RFDS for the project (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona), development in the planning area can be expected to result in a generating capacity of 820 MW, including 130 MW on BLM-administered lands by 2025. Using the estimates provided above, the RFDS for the BLM-administered lands include a low of 52 to a high of 487 jobs for construction (average 172 jobs) and 6.5 to 26 jobs for operations and maintenance (average 12 jobs).

For both wind and solar, the majority of jobs are available during the construction phase; generally, operation and maintenance require far fewer jobs. Renewable energy construction and operation and maintenance demands skilled labor, and this skilled labor may or may not be available through the local workforce. Many developers try to hire local construction companies and local operators; however, when this is not possible, construction companies are often brought on from outside of the county or even the state (Pedden 2006). Therefore, the impacts on the local labor force are contingent upon the availability of skilled labor, natural resources, and industries that exist in the area. Similarly, revenue brought into the local community may vary. Wages of construction and operations and maintenance workers would differ based upon skill level required, local costs of living, demand for employment at the time of development, and other local and national economic factors. In addition to direct income, workers may spend money in the local economy, contributing a secondary source of revenue for local businesses. Indirect revenues would vary based on the variables discussed above.

Impacts on Tax Revenue

Increased spending as a result of renewable energy development in local communities is likely to increase tax revenue. The degree of increase in sales tax revenue that is allotted from solar and wind projects depends upon many factors, including the existing local infrastructure that might accommodate the influx of workers, and the overall increase in workers in the area. Various benefits to local communities and counties may result from construction payrolls, local purchases of materials and supplies, and sales tax revenues generated by expenditures (California Energy Commission 2011e).

The impact on communities varies with the size and available infrastructure-related resources of that community. Small communities may experience leakage, which is when taxes are paid to other counties or municipalities due to a lack of available infrastructure in the immediate vicinity where money would otherwise be spent. As a result, small communities may see less economic benefits than a larger community able to provide a greater number of services, as workers at renewable energy projects would commute to nearby towns that provide more services (Pedden 2006).

Impacts on Property Values

There is currently limited research that assesses the impact renewable energy projects have on property values. A 2009 study by the Lawrence Berkeley National Laboratory examined the influence of wind energy facilities on property values (Hoen et al. 2009). The study's methodology entailed collecting sales data on single-family homes situated within 10 miles of existing wind facilities. There was no conclusive evidence of the existence of any widespread property value impacts that affect communities surrounding wind energy facilities. In addition, the Draft Solar PEIS (BLM and DOE 2010) concludes that while there may be a small negative effect on property values in the immediate

vicinity (i.e., less than one mile) of facilities, this effect is often temporary and associated with announcements related to specific project phases, such as site selection, the start of construction, or the start of operations. At larger distances or over longer project durations, no significant, enduring decrease in property value as a result of renewable energy development has been found (BLM and DOE 2010).

Furthermore, there is some evidence that property values may increase as a result of renewable energy projects in the vicinity. A study completed in 2003 examined price changes in property values for 10 different wind projects. For the majority of projects, the property values in the viewshed went up faster than values in the comparable region (Sterzinger et al. 2003). Commercial property value may be impacted differently than single family homes due to the potential for increased development opportunities near renewable plants. Similarly, transmission line development may have impacts on property values. Property value impacts would be examined for site-specific development.

Changes to Current Land Use

Current land use may be impacted by renewable energy development. As further discussed in **Sections 4.2.22**, Visual Resources, and **4.2.15**, Recreation, changes to the visual landscape and public access to public lands, respectively, may be impacted when wind or solar is introduced to a previously undisturbed parcel of land. Open space that may have been used for OHV use, hiking, camping, sightseeing, bird watching, or similar recreational use could be impacted if construction occurred in areas where these activities were valued. Social impacts could occur on local communities if access to these resources was a valued component of the community. Economic impacts can occur if associated visitor spending for tourism or recreation purposes is affected. Recreation can be negatively impacted because lands that were previously used for recreation can be replaced by the infrastructure of the project, or access routes to lands can be deemed inaccessible due to construction or other project development. In other cases, the creation of infrastructure such as transmission can create corridors or access to large areas of land where access did not previously exist (BLM 2011a, 2011b).

In addition, changes to availability of land for other land uses such as livestock grazing or mineral extraction may impact area socioeconomics. In communities dependent on ranching, reduction in AUMs on public land allotments may increase the costs of grazing due to the higher fees for use of private lands and may impact adjacent land value. Furthermore a loss of public grazing lands may change the social structure of the community in areas where this economic sector was of historical importance. The potential magnitude and nature of these impacts should be considered in project-specific analyses.

Social Changes to Local Communities

Social changes could occur that would impact local communities. Construction- and operation-related impacts could change the local quality of life by altering values such as air quality due to fugitive dust, visual resources due to site infrastructure, or area traffic due to workers travelling to a work site. A population influx in a community could influence various factors such as transportation, including traffic associated with site workers; availability of health care workers or public service officers; demands on public safety officers; housing, particularly in cases where housing vacancy rates are low; and waste disposal, water availability, or telecommunications services if these services are only adequate for the current population. Impacts would predominantly be related to construction and therefore temporary in nature, as renewable energy plants have minimal permanent operations and maintenance workers requirements. The degree of impact is contingent upon the size of the community, the local infrastructure, and the influx of workers anticipated.

Non-Market Values

Public lands provide services to the region and to local community residents by providing a source of public open space that may be important for local residents for the feel of a community or for recreational use. In addition, the BLM-administered lands may produce a wide range of valuable ecosystem services (the resources and processes that are supplied by natural ecosystems), including agriculture, drinking water, flood control, carbon sequestration, recreation, and preservation of cultural resources. Ecosystem services are generally understood to be the benefits of nature to individuals, communities, and economies (DOI 2011). Impacts would be determined by local area communities and conditions.

Impacts from the No Action Alternative

The impacts related to renewable energy development under the No Action Alternative would be the same as those described in Impacts Common to All Alternatives. Developing solar and wind energy projects on a case-by-case basis through ROW authorizations are not expected to directly affect land uses and access because the BLM is required to identify and address environmental impacts of all ROW authorizations and conform to existing land use plan decisions. However, in the absence of identifying the REDA, solar and wind project development would likely result in fragmented and segregated land uses and access. Additionally, there could be increased unanticipated environmental impacts from the lack of planning for appropriate land uses, which could alter the character of rural areas and increase the potential for social or economic impacts on local communities. As necessary, individual BLM land use plans would have to be amended for individual projects as a part of the project evaluation and approval, which could delay the process. No standard set of BMPs or design features would be developed.

Impacts from Alternative 1

Impacts from Maximum REDA

Under Alternative 1, impacts would be similar to those described under Impacts Common to All Alternatives. While the exact location of development cannot be determined, the REDA would direct renewable energy development on public lands to specific regions in the planning area. While smaller parcels of land within the REDA can be found throughout the state, the largest concentrations are found within the Sonoran Desert south and west of Phoenix, centered near the intersection of Highway 85 and Interstate 8 near Gila Bend; in Mohave County north of Interstate 40 near Kingman; and on the southern half Navaho and Apache Counties. The REDA on public lands reflects the same general distribution, particularly in the Sonoran Desert and in Mohave County (**Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario). The majority of areas available for development would not be located adjacent to large population centers. Impacts on local communities during construction could occur should a large number of workers be required to temporarily move to the area. Should a large development occur in the Sonoran Desert, for example, a strain on housing and service resources may occur in the Gila Bend community, although it is likely that workers could be drawn from the existing pool of those seeking employment in the greater Phoenix region and no large population influx would occur. Availability of housing and workers would be influenced by local economic conditions at the time of development and would be analyzed in site-specific NEPA analysis.

Impacts from construction such as dust and noise as well as impacts on community watersheds would be minimized through project design criteria and BMPs. Jobs and related income, tax revenue, and social changes to local communities would differ depending on the location of site-specific development. Due to the temporary nature of construction activities and the small number of full-time employees required for renewable energy plants, long-term impacts would likely be minimal. In addition, the RDEP encourages development on previously disturbed lands and those lands with fewer resource conflicts, thus retaining lands with high value for community use as well as lands providing valuable ecosystem services.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be to the same as those described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ is located adjacent to a 290-MW solar facility currently under construction on private land mainly surrounded by rural and undeveloped lands; therefore, there are likely to be minimal social and economic impacts immediately surrounding the site. Based on analysis provided in Impacts Common to All Alternatives, development in the proposed SEZ would likely require between 18 to 40 temporary construction jobs and 2 to 14 permanent operations and maintenance jobs. While the proposed SEZ is located in an area with a low population base, due to the small number of workers required, workers could likely be drawn from the region,

and a large population influx would not be anticipated. Similarly, workers for project construction and operation are not likely to have a long-term significant impact on local community economies.

If the proposed Agua Caliente SEZ were developed, there could be conflicts with existing land uses (primarily recreation) within the proposed SEZ. Implementing the programmatic design features such as stakeholder coordination/consultation as described in **Appendix B**, Design Features and Best Management Practices, would provide adequate mitigation for activities.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Impacts would be similar in scope and nature to those described for Alternative 1. The necessary transmission connections would be less due to the REDA boundaries being closer to existing infrastructure; therefore, impacts on communities from this infrastructure would be reduced. However, due to the fewer acres in the Alternative 2 REDA, there would be less flexibility in siting solar and wind facilities and infrastructure, which may result in additional impacts on current land use as described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be similar in scope and nature to those described for Alternative 1. Overall, impacts on existing land use such as recreation on BLM lands would be reduced because of the smaller footprint.

Impacts from Alternative 3

Impacts from Load Offset REDA

Impacts would be similar in scope and nature to those described under Alternative 1. However, under this alternative solar and wind development would be concentrated near developed areas (e.g., cities, towns, or industrial areas). Due to location, workers for construction and operation are more likely to be available in the existing pool of employees in the area. Area public services for workers are also more likely to be available and the strain on these services would therefore be minimal. When project siting occurs in industrial areas, this type of development would likely be more consistent with surrounding land uses and would be less likely to impact land used for dispersed recreation, which typically occurs in less developed backcountry settings. Impacts, however, would be more likely to occur on developed recreation areas in close proximity to population centers. Impacts from construction on local communities may be present should siting occur near residential populations. Project-related BMPs and design features should reduce impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be similar in scope and nature to those described for Alternative 1. Under this alternative; however, the proposed SEZ footprint is very small (2,760 acres), with the boundaries close to the existing solar energy

development and away from key recreational areas, resulting in a reduction of impacts on existing land uses such as recreation.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Impacts would be similar in scope and nature to those described for Alternative1 due to the size of the REDA and the location and percentage of developable land.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be same as those described under Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Impacts would be similar in scope and nature to those described for Alternative 1. Only BLM-administered lands are identified for potential solar and wind energy development; therefore, overall potential for employment would be decreased, as would related impacts on local and regional economic and social structure.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Impacts would be similar in nature to those described under Impacts Common to All Alternatives and Alternatives 1, 2, and 3. However, developable land in the REDA would be located in proximity to existing transmission lines and communities, as described for Alternatives 2 and 3, which would reduce the impacts on local communities.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be similar in scope and nature to those described under Alternative 2.

4.2.17 Soil Resources

Evaluation Methodology, Resource Indicators, and Assumptions

This section discusses impacts on soils from proposed management actions, design features, and BMPs as noted in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning soil resources are described in **Section 3.17**, Soils Resources. Impacts on soils would result from actions that cause ground-disturbing activities, alter vegetative cover, or otherwise affect the potential for soil erosion.

NRCS data were consulted to provide an overview of baseline soil conditions for the planning area in **Chapter 3**, Affected Environment. Soils throughout the planning area are described by soil order for general geographic areas. Soils in the proposed Aqua Caliente SEZ are described by acres of soil unit type.

The specific impacts of development of solar and wind energy facilities would depend on project location, technology and scale employed, size of the development, and site-specific soil conditions. Due to the uncertainty of specific solar and wind development, it is not possible to quantify the total acreage affected on lands within the planning area or identify the soil units that would be impacted, other than to identify the acreage of land that could be affected by maximum build-out. Implementation-level actions (development of specific solar and wind facilities) would be subject to further environmental review and would include quantifying the total acreage affected by site-specific development.

Potential impacts on soil resources could occur if anticipated future actions described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, were to result in the following:

- Alter vegetative cover;
- Alter road density;
- Result in developments or other activities causing surface disturbance on soils with high wind or water erosion potential; or
- Result in disturbances from management activities that damage the surface cover provided by desert pavement or biological soil crusts.

This analysis assumes the following:

- Soil resources will be managed to meet the Arizona Land Health Standards and Guidelines.
- Substantial surface disturbance to soil, including exposure of bare ground, loss of vegetative cover, or rutting on unsurfaced roads will increase water runoff and downstream sediment loads and lower soil productivity, thereby degrading water quality, altering channel structure, and affecting overall watershed health.
- The degree of impact attributed to any one disturbance or series of disturbances would be influenced by several factors, including the disturbance's location within the watershed, the time and degree of disturbance, the existing vegetation, and levels of precipitation at the time of the disturbance.
- Any access roads will be properly designed.
- Stockpiling of surface soils will occur for future restoration after grading or excavation.
- Design features and BMPs identified in **Appendix B** would be implemented for site-specific projects.

Impacts Common to All Alternatives

Renewable energy development impacts on soil resources would predominantly be related to surface-disturbing activities, which may result in soil compaction, disruption of biological crusts or desert pavement, or other changes affecting the rate of or spatial locations of soil erosion or deposition. In turn, erosion can affect soil productivity by carrying away soil particles and nutrients normally held in the upper level or horizon of soil. The ability of the soil to recover productivity is affected by loss or degradation of the upper horizons. Given the low precipitation and limited vegetation levels in the planning area, soil productivity will be slow to recover once it has been reduced by erosion.

No field inventory of soils was available for this project. Site-specific NEPA analysis conducted prior to project approval and development would examine impacts on soil resources in further detail, including an analysis of soil types and associated soil features. Overall, the RFDS (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona) for solar development predicts that up to 12,000 acres of BLM-administered land may be disturbed for solar energy production by 2020. Similarly, the RFDS for wind approximates that 3,600 acres of BLM-administered land would be developed for wind energy by 2020. Of the 3,600 acres of wind projects on BLM-administered lands, approximately 360 of those acres are expected to be disturbed in the development process.

Due to the inability to predict future development scenarios, including types of development, timing, and location, the following impact analysis provides a general description of common impacts on soil resources during project construction, operations and maintenance, and reclamation and abandonment. Impacts during siting and development would be minimal due to lack of significant surface disturbance and are not discussed further.

Construction

Site construction for renewable energy projects would involve vegetation removal and site grading, which may disrupt drainage patterns and cause surface disturbance and erosion, resulting in impacts on soil resources. The magnitude of the impact would depend on the project size, renewable technology developed, erosion potential of the soil, local terrain, vegetation cover, and the distance from a site to nearby surface water bodies. Major factors that could contribute to soil erosion include the following:

- Amount of ground surface disturbance on project sites, construction laydown areas, along access roads, and along transmission line routes. Disturbance includes, but is not limited to, disruption of protective soil crusts;
- Amount of foot traffic from construction workers and heavy equipment traffic from construction vehicles; and
- Surface runoff pattern disturbance due to grading or excavation.

Addition potential impacts include exposure of workers and the local environment to contaminated soils disturbed during construction. Contaminated soils are of particular importance for disturbed sites nominated for renewable energy development due to potential contamination from previous uses. Additional details are included in **Section 4.2.14**, Public Health and Safety.

Operations and Maintenance
Impacts during the operation phase would largely be limited to soil erosion induced by vehicle traffic on unpaved roads. Additional impacts may include soil subsidence from use of groundwater for renewable energy, particularly wet-cooling. Additional details are included in **Section 4.2.23**, Water Resources.

Reclamation and Abandonment
Impacts during reclamation and abandonment would be similar to those described for construction, as soils would be disturbed again with the removal of all access roads, on-site roads, substations, buildings, and other structures. Use of site decommissioning and site reclamation plans would restore exposed soils in the long term.

Additional impacts could result to prime farmlands. Soil productivity in prime farmlands may be impacted by erosion should development occur in these areas. Site-specific NEPA analysis would include analysis for prime farmlands.

Impacts from the No Action Alternative
Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind development by statute, regulation, or orders would remain excluded, and administratively excluded areas would be assessed based on local land use plans. Solar and wind energy project applications would be submitted to the BLM by energy developers based on resource availability, economics, and site suitability. No standard set of design criteria or BMPs for soil resources would be developed. The acreage of impacted soil resources is unknown.

Impacts from Alternative 1
Impacts from Maximum REDA
There would be no direct impacts from the identification of a REDA. Indirect impacts on soil resources could result from implementing the planning decisions and possible future ground-disturbing activities associated with construction of renewable energy facilities. Under Alternative 1, solar and wind energy project applications would be submitted to the BLM from energy developers based on resource availability, economics, and site suitability. Potential impacts would be similar in nature to those described under Impacts Common to All Alternatives. BMPs and design features (**Appendix B**, Design Features and Best Management Practices) would be employed to minimize soil erosion. In addition, wind erosion control techniques would be put in place, native vegetation cover and soils would be maintained to the extent possible, grading and excessive slopes

would be minimized, construction would be conducted in stages to limit the areas of exposed soil at any given time, and roads would be built according to BLM standards to avoid erosion. Additionally, measures would be put in place to minimize risks from contaminated soils. If any newly found potentially contaminated soils are discovered, contractors would stop work immediately in that area and notify the project proponent, and a qualified professional would inspect the site.

The acres of the REDA by soil order are shown in **Table 4-6**, Soil Orders in the REDA – Alternative 1. The REDA is composed primarily of Aridisols, which due to characteristic sparse vegetative cover and low organic content, are highly susceptible to erosion. It should be noted that the acreage in Table 4-6 represents the amount of BLM-administered land in the REDA; the amount of soil impacted by ground-disturbing activities would be significantly less. Site-specific soil characteristics and erosion potential would be examined during subsequent NEPA analysis for site-specific projects. Implementing BMPs and design features, as appropriate, would reduce impacts on soil resources.

Table 4-6
Soil Orders in the REDA – Alternative 1

Soil Order	BLM-administered Land (acres)
Alfisols	3,800
Aridisols	294,100
Entisols	16,300
Inceptisols	0
Mollisols	1,600
Vertisols	2,200
Miscellaneous	3,500

Source: NRCS 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

Soil resources in the proposed SEZ would be impacted by construction, operations, and reclamation activities as described in Impacts Common to All Alternatives. As described in **Section 3.17**, Soil Resources, soils in the proposed SEZ have low to moderate susceptibility to erosion. Under Alternative 1, the proposed SEZ is dominated by Ligurta-Cristobal complex, 2 to 6 percent slopes, which has low potential for both water and wind erosion. Acres of each soil in the proposed SEZ are shown in **Table 4-7**, Soil Series in the Proposed Agua Caliente SEZ – Alternative 1. Soil features as well as site design features and BMPs would limit the potential for impacts on soil resources.

Table 4-7
Soil Series in the Proposed Agua Caliente SEZ – Alternative 1

Soil Name	Acres in Proposed SEZ
Carrizo very gravelly sand	2,470
Cherioni-Rock outcrop complex, 25- to 70-percent slopes	10
Harqua-Tremant complex	3,680
Ligurta-Cristobal complex, 2- 6-percent slopes	14,430

Source: NRCS 2011f

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the REDA is reduced compared to Alternative 1, so the scale of impacts would be less. Acres within the planning area by soil order are shown in **Table 4-8**, Soils Orders in the REDA – Alternative 2.

Table 4-8
Soil Orders in the REDA – Alternative 2

Soil Order	BLM-administered Land (acres)
Alfisols	0
Aridisols	210,000
Entisols	6,500
Inceptisols	0
Mollisols	300
Vertisols	0
Miscellaneous	1,800

Source: NRCS 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the SEZ is reduced compared to Alternative 1, so the scale of impacts would be less. Acres within the proposed SEZ by soil type are shown in **Table 4-9**, Soil Series in the Proposed Agua Caliente SEZ – Alternative 2.

Table 4-9
Soil Series in the Proposed Agua Caliente SEZ – Alternative 2

Soil Name	Acres in Proposed SEZ
Carrizo very gravelly sand	240
Cherioni-Rock outcrop complex, 25- to 70-percent slopes	0
Harqua-Tremant complex	1,580
Ligurta-Cristobal complex, 2- to 6-percent slopes	4,950

Source: NRCS 2011f

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the REDA is reduced compared to Alternative 1, so the scale of impacts would be less. Acres within the proposed SEZ by soil type are shown in **Table 4-10**, Soil Orders in the REDA – Alternative 3.

Table 4-10
Soil Orders in the REDA – Alternative 3

Soil Order	BLM-administered Land (acres)
Alfisols	0
Aridisols	122,000
Entisols	6,600
Inceptisols	0
Mollisols	200
Vertisols	0
Miscellaneous	1,000

Source: NRCS 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the SEZ is reduced as compared to Alternative 1, so the scale of impacts would be less. Acres within the proposed SEZ by soil order are shown in **Table 4-11**, Soil Series in the Proposed Agua Caliente SEZ – Alternative 3.

Table 4-11
Soil Series in the Proposed Agua Caliente SEZ – Alternative 3

Soil Name	Acres in Proposed SEZ
Carrizo very gravelly sand	210
Cherioni-Rock outcrop complex, 25- to 70-percent slopes	0
Harqua-Tremant complex	800
Ligurta-Cristobal complex, 2- to 6-percent slopes	1,750

Source: NRCS 2011f

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The scale and nature of impacts would be similar to those described under Impacts Common to All Alternatives and Alternative 1; however, design features under this alternative would limit the impacts of water usage on soils, most importantly, soil subsidence.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA
The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the REDA is reduced as compared to Alternative 1, so the scale of impacts would be less. Acres within the planning area by soil order are shown in **Table 4-12**, Soil Orders in the REDA – Alternative 5.

Table 4-12
Soil Orders in the REDA – Alternative 5

Soil Order	BLM-administered Land (acres)
Alfisols	0
Aridisols	41,400
Entisols	1,800
Inceptisols	0
Mollisols	0
Vertisols	0
Miscellaneous	500

Source: NRCS 2011a

Impacts from Alternative 6

Impacts from Collaborative-Based REDA
The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the REDA is reduced as compared to Alternative 1, so the scale of impacts would be less. As in Alternative 4, additional design features under this alternative would limit the impacts of water usage on soils, most importantly, soil subsidence. Acres within the planning area by soil order are shown in **Table 4-13**, Soil Orders in the REDA – Alternative 6.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 2.

Table 4-13
Soil Orders in the REDA – Alternative 6

Soil Order	BLM-administered Land (acres)
Alfisols	0
Aridisols	226,200
Entisols	8,600
Inceptisols	0
Mollisols	500
Vertisols	0
Miscellaneous	1,800

Source: NRCS 2011a

4.2.18 Special Designations

Evaluation Methodology, Resource Indicators, and Assumptions

Areas with special designations (see **Section 3.18**, Special Designations) have been identified as "Areas with Known Sensitive Resources" (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]). As such, these lands have been eliminated from consideration as a REDA, and direct impacts are not anticipated. However, special designation areas may experience impacts from solar or wind energy development on adjacent or nearby REDA or SEZ lands. As such, a five-mile radius around REDA lands and the proposed Agua Caliente SEZ was analyzed for potential impacts on those values and resources identified for protection under any special designations within that area.

Potential impacts on special designations could occur if reasonably foreseeable future actions were to result in the following:

- Conflict with management goals and objectives set forth by the BLM and other agencies in order to categorize, protect, and manage special designation areas;
- Conflict with conservation goals for the area; or
- Result in proposed land uses that are incompatible with existing or adjacent special designation areas.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind energy development applications would continue to be processed on a case-by-case basis. Most congressionally designated areas in the planning area (see **Section 3.18**, Special Designations) are precluded from renewable energy development; therefore, it is anticipated that impacts on congressional designations would be negligible. In administrative designations, where wind and solar energy development is not

automatically precluded, field offices would determine if wind and solar energy development would be in conformance with the prescriptions outlined in the relevant land use plan(s).

If wind or solar energy development was permitted in a special designation area, prior to any activity occurring, resources and values identified for protection under the designation would be analyzed for potential impacts. Activities affecting resources and values identified for protection in these areas would be prohibited, resulting in negligible impacts on special designations.

Impacts from Alternative 1

Impacts from Maximum REDA

Areas with special designations have been eliminated from consideration as a REDA. Within five miles of the REDA, there are 33 ACECs, 3 backcountry byways, 3 national conservation areas, 5 national monuments, 5 national parks, 37 wilderness areas, and 2 WSAs (see **Figure 4-1**, Alternative 1: Maximum REDA within 5 miles of Special Designations). Within 5 miles of BLM-administered lands within the REDA, there are 19 ACECs, 2 backcountry byways, 2 national conservation areas, 5 national monuments, 5 national parks, 28 wilderness areas, and 1 WSA. Solar and wind energy development within the REDA could impact these areas by affecting scenic, cultural, or fish and wildlife resources as described in **Sections 4.2.22**, Visual Resources, **4.2.3**, Cultural Resources, and **4.2.6**, Fish and Wildlife, respectively.

Impacts from Proposed Agua Caliente Solar Energy Zone

There are no special designations within the proposed Agua Caliente SEZ under Alternative 1. The Sears Point ACEC is within five miles of the proposed SEZ however solar energy development is not anticipated to alter the cultural resources for which the ACEC was designated. To the extent that cultural resources for which the ACEC was designated rely on an unmodified viewshed to protect the values, the ACEC may be impacted by CSP development in the proposed SEZ as CSP development would be visible from the ACEC. See **Section 4.2.22**, Visual Resources, for more information.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, the type of impact would be the same as those described for Alternative 1, but fewer special designation areas have the potential to be impacted. Within 5 miles of the REDA, there are 27 ACECs, 3 backcountry byways, 3 national conservation areas, 4 national monuments, 17 national parks, 30 wilderness areas, and 1 WSA. Within 5 miles of BLM-administered lands within the REDA, there are 18 ACECs, 2 backcountry byways, 2 national conservation areas, 4 national monuments, 2 national parks, 25 wilderness areas, and 1 WSA. Solar and wind energy development within the REDA could impact

Alternative 1: Maximum REDA on BLM-Administered Lands within 5 Miles of Special Designations

Areas with special designations have been eliminated from consideration as REDA. However, special designation areas may experience impacts from solar or wind energy development in adjacent or nearby REDA.

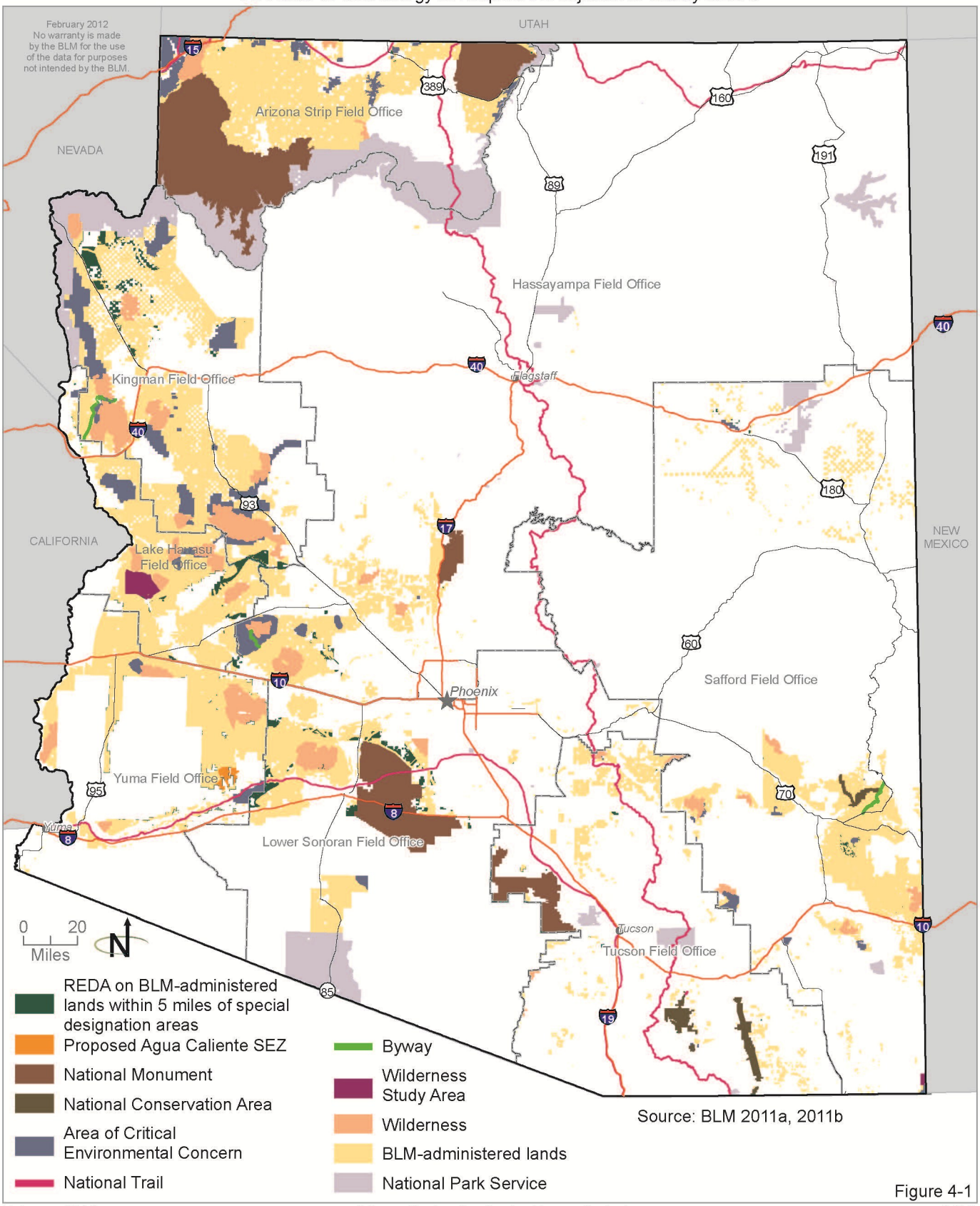


Figure 4-1

these areas by affecting scenic, cultural, or fish and wildlife resources as described in **Sections 4.2.22**, Visual Resources, **4.2.3**, Cultural Resources, and **4.2.6**, Fish and Wildlife, respectively.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on special designations from the proposed SEZ under Alternative 2 would be similar to those described for Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
Under Alternative 2, the type of impact would be the same as those described for Alternative 1, but fewer special designation areas have the potential to be impacted. Within 5 miles of the REDA, there are 21 ACECs, 3 backcountry byways, 3 national conservation areas, 3 national monuments, 12 national parks, 25 wilderness areas, and 1 WSA. Within 5 miles of BLM-administered lands within the REDA, there are 13 ACECs, 1 backcountry byway, 2 national conservation areas, 4 national monuments, 4 national parks, 19 wilderness areas, and 1 WSA. Solar and wind energy development within the REDA could impact these areas by affecting scenic, cultural, or fish and wildlife resources as described in **Sections 4.2.22**, Visual Resources, **4.2.3**, Cultural Resources, and **4.2.6**, Fish and Wildlife, respectively.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on special designations from the proposed SEZ under Alternative 3 would be similar to those described for Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Impacts on special designations under Alternative 4 would be the same as those described for Alternative 1. The number of special designation areas within five miles of the REDA would be the same as under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on special designations from the proposed SEZ under Alternative 4 would be the same as those described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under Alternative 2, the type of impact would be the same as those described for Alternative 1, but fewer special designation areas have the potential to be impacted. Within 5 miles of the REDA, there are 8 ACECs, 2 national conservation areas, 4 national monuments, 4 national parks, 14 wilderness areas, and 1 WSA. Solar and wind energy development within the REDA could impact these areas by affecting scenic, cultural, or fish and wildlife resources as described in **Sections 4.2.22**, Visual Resources, **4.2.3**, Cultural Resources, and **4.2.6**, Fish and Wildlife, respectively. There are no backcountry byways within five miles of the REDA.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Impacts on special designations under Alternative 6 would be similar to those described for Alternative 1. Within 5 miles of the REDA, there are 29 ACECs, 3 backcountry byways, 3 national conservation areas, 4 national monuments, 14 national parks, 30 wilderness areas, and 1 WSA. Within 5 miles of BLM-administered lands within the REDA, there are 18 ACECs, 2 backcountry byways, 2 national conservation areas, 4 national monuments, 4 national parks, 25 wilderness areas, and 1 WSA. Solar and wind energy development within the REDA could impact these areas by affecting scenic, cultural, or fish and wildlife resources as described in **Sections 4.2.22**, Visual Resources, **4.2.3**, Cultural Resources, and **4.2.6**, Fish and Wildlife, respectively.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on special designations from the proposed SEZ under Alternative 6 would be similar to those described for Alternative 1.

Unavoidable Adverse Impacts

Solar and wind energy development within the REDA could impact special designation areas within five miles of the REDA by affecting scenic, cultural, or fish and wildlife resources. Impacts would depend on a project's location and extent, timing, technology, and topography between the proposed site and the potentially affected special designation area.

4.2.19 Special Status Species

Evaluation Methodology, Resource Indicators, and Assumptions

This section discusses impacts on special status species from the proposed allocation decisions, management actions, design features, and BMPs as noted in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, and in **Appendix B**, Design Features and Best Management Practices.

This analysis addresses potential impacts on special status species from implementing the management actions under the alternatives described in Chapter 2. Existing conditions concerning special status species, including detailed species lists, are included in **Section 3.19**, Special Status Species. Impacts on general wildlife, including big game and migratory birds, are addressed in **Section 4.2.6**, Fish and Wildlife. This analysis focuses on solar and wind energy development that has the potential for physical harm, disturbance, or harassment of species, as well as loss or alteration of habitat.

Potential impacts on special status species would vary widely depending on a variety of factors such as the dynamics of the habitat (e.g., the community type, size, shape, complexity, stage, and condition of plant or animal communities); season of construction; extent of the disturbance; type of renewable technology developed; rate of vegetative recovery and composition of this vegetative

community; change in vegetation structure and value, soil type, topography and microhabitat of the developed sites; animal species that are present; and the ability of individual species to adapt or move from a site following a disturbance.

Because specific development and site-specific information is not available, species-specific information will be analyzed in detail on a project-level basis, with the exception of the proposed SEZ.

Potential impacts on special status species could occur if anticipated future actions as described in Chapter 2 were to result in the following:

- Harm, harass, or adversely affect any federally listed threatened or endangered species or federally proposed or candidate species;
- Adversely affect the recovery objectives of a federally listed species recovery plan or promote the likelihood of or need for listing under the ESA;
- Destroy or deteriorate federally listed threatened or endangered species' or federally proposed or candidate species' habitat, migration corridors, breeding areas, or designated or proposed critical habitat;
- Decrease population viability or contribute to the need for a federal listing of any federal candidate species or BLM sensitive species; or
- Result in loss of habitat function or habitat value in BLM sensitive species habitats.

Indicators include the following:

- Location, type, and intensity of disturbances relative to known or potential special status species habitat.
- Extent of disturbance and amount of habitat removed.
- Tolerance of a given special status species to disturbance.
- Likelihood for an activity to cause a special status species population to drop below self-sustaining numbers or cause a substantial loss or disturbance to habitat.
- Likelihood for adverse effects on a federally listed or proposed species, as defined under the ESA.
- Effects to the constituent elements required to support a listed species.
- Likelihood for an activity to contribute to the need to list any BLM sensitive or federal candidate species.

This analysis assumes the following:

- Qualitative analysis represents estimates only since many special status species may potentially use habitats that are currently unoccupied and populations fluctuate.
- Ground-disturbing activities could lead to modification of habitat and/or loss or gain of individuals, depending on the amount of area disturbed, nature of the disturbance, the species affected, and the location of the disturbance.
- Implementation-level actions would be further assessed at an appropriate spatial and temporal scale and level of NEPA analysis. Additional field inventories would likely be needed to determine whether any special status species could be present in a given project area.
- Requirements for consultation with USFWS would be followed as appropriate.
- BMPs and standard operating procedures, outlined in **Appendix B**, Design Features and Best Management Practices, are used for analysis purposes and would be implemented to reduce impacts on special status species. These are subject to modification based on subsequent guidance.

Impacts Common to All Alternatives

Special status species within the planning area include those species that are listed by USFWS as federally endangered, threatened, proposed, or candidate species under the ESA, Section 4, as amended; Arizona BLM Sensitive Species; Wildlife of Special Concern by the AZGFD; or are protected under the Arizona Native Plant List by the AZDA.

Impacts on special status species from utility-scale solar are described in the Draft Solar PEIS (Section 5.10, Table 5.10-4) and are incorporated here by reference (BLM and DOE 2010). Impacts from non-utility-scale solar would be similar but at a smaller magnitude. Impacts on special status species from wind operations are summarized in the PEIS on Wind Energy Development (BLM 2005b, Section 5.9).

Impacts on special status species are fundamentally similar to or the same as those described for impacts on vegetation (**Section 4.2.21**) and on fish and wildlife (**Section 4.2.6**). Special status species, however, may be more vulnerable to impacts than common species due to small population size, limited geographic range, reliance on rare habitat types, and habitat conversion. These factors make them more vulnerable to the effects of habitat fragmentation, habitat alteration, habitat degradation, human disturbance and harassment, mortality of individuals, and the loss of genetic diversity.

For special status species like the Sonoran desert tortoise, design features are included in this document to protect species, including but not limited to education of workers on the identification of and protection measures for special status species, pre-disturbance surveys for special status species and habitats, and clearing and translocation of special status species as determined appropriate on a project-specific basis. These measures would be required for projects as appropriate based on habitat and likelihood of species occurrence. Detailed design features and BMPs are included in **Appendix B**, Design Features and Best Management Practices.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind leasing by statute, regulation, or orders would remain excluded, and administratively excluded areas would be assessed based on local land use plans. Impacts on special status species would be assessed on a project-specific level and measures to avoid important habitat and mitigate impacts would be undertaken. In the absence of identifying the REDA, however, solar and wind project development would likely result in patchy, fragmented development with an increased likelihood of habitat disturbance and fragmentation for special status species. In addition, no standard set of design features or BMPs would be developed for protection of special status species.

Impacts from Alternative 1

Impacts from Maximum REDA

The REDA has been designed to minimize impacts on special status species by directing future development to areas where current habitat values are poor or fragmented and potential for special status species occupation is limited. As discussed in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, areas eliminated from REDA consideration include USFWS critical habitat, AZGFD locations of special status species, including ESA-listed and proposed species, BLM sensitive species habitat, and desert tortoise habitat in priority habitat categories.

While the limited potential for special status species to be injured, killed, or disturbed due to project construction or operations remains, impacts would be minimal due to the exclusion of important habitat areas and the existing uses of the REDA, which are disturbed sites and do not provide suitable special status species habitat. In addition, some impacts may occur due to changes in habitat adjacent to that used by special status species. Alteration in habitat may impact species by reducing the areas available for use as corridors, fragmenting habitat or otherwise impeding movement of individuals which could in turn impact genetic flow and diversity. Design features and BMPs as described in **Appendix B**, Design Features and Best Management Practices, would require pre-operations site surveys and mitigation and monitoring as appropriate. It is assumed that these and other general BMPs for wildlife protection would limit

impacts on special status species. Site-specific NEPA analysis would be conducted to determine impacts for species at the project level.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and types of impacts that special status species could incur from construction, operations/maintenance, and reclamation/abandonment of utility-scale solar energy facilities are discussed in **Sections 4.2.21**, Vegetation, and **4.2.6**, Fish and Wildlife. The affected areas would be the same as those described for the proposed SEZ in **Section 4.2.6**, Fish and Wildlife. This analysis is based on the potentially occurring special status species listed for the proposed SEZ in **Section 3.19**, Special Status Species. No special status species have been recorded within the proposed SEZ.

Abert's Towhee. The woodlands and thickets within the proposed SEZ and surrounding areas could provide potential foraging habitat for Abert's towhee, though no nesting habitat is present. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, Design Features and Best Management Practices, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on Abert's towhee.

Cactus Ferruginous Pygmy Owl. Three of the six main washes within and around the proposed SEZ support riparian vegetation that could provide potential nesting and foraging habitat for the cactus ferruginous pygmy owl. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, Design Features and Best Management Practices, such as avoiding land disturbance and road construction in desert washes, would protect habitat from removal associated with solar energy development. Other design features would minimize disturbance caused by construction noise and disruptions during the breeding season. These design features would reduce the likelihood for impacts on cactus ferruginous pygmy owl.

Ferruginous Hawk. The open scrublands within the proposed SEZ and surrounding areas could provide potential foraging habitat for ferruginous hawk, though no nesting habitat is present. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, Design Features and Best Management Practices, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on ferruginous hawk.

Gila Woodpecker. The creosote bush scrub within and around the proposed SEZ could provide potential nesting and foraging habitat for gila woodpecker. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as

requiring pre-construction nesting bird surveys, establishing buffer areas, and using noise-reduction devices, would reduce the likelihood of impacts on gila woodpecker.

Gilded Flicker. The creosote bush scrub and ironwood within and around the proposed SEZ could provide potential nesting and foraging habitat for gilded flicker. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction nesting bird surveys, establishing buffer areas, and using noise-reduction devices, would reduce the likelihood of impacts on gilded flicker.

Golden Eagle. All of the proposed SEZ and surrounding areas could provide potential foraging habitat for golden eagle, though no nesting habitat is present. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, Design Features and Best Management Practices, such as requiring adherence to BLM and USFWS golden eagle guidance as well as incorporating actions to avoid eagle disturbance, would reduce the likelihood for impacts on golden eagle.

LeConte's Thrasher. The creosote bush scrub within and around the proposed SEZ could provide potential nesting and foraging habitat for LeConte's thrasher. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction nesting bird surveys, establishing buffer areas, and noise reduction devices, would reduce the likelihood for impacts on LeConte's thrasher.

Mountain Plover. The open scrublands within the proposed SEZ and surrounding areas could provide potential wintering habitat for mountain plover, though no nesting habitat is present. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on mountain plover.

Western Burrowing Owl. Some of the desert scrub habitat within and around the proposed SEZ has suitable soils and erosional features that could be used by burrowing owls for nesting and foraging. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction nesting bird surveys, establishing buffer areas, and noise reduction devices, would reduce the likelihood for impacts on burrowing owl.

Arizona Pocket Mouse. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for Arizona pocket mouse. The nature and types of potential impacts would be similar to those described in

Section 4.2.6, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on Arizona pocket mouse.

California Leaf-Nosed Bat, Cave Myotis, Mexican Free-tailed Bat, Pale Townsend's Big-Eared Bat, Pocketed Free-tailed Bat, Spotted Bat, Western Yellow Bat, Yuma Myotis. The desert scrub habitat within and around the proposed SEZ could provide potential foraging habitat for sensitive bat species. In addition, the riparian habitat within the proposed SEZ could provide potential roosting habitat for western yellow bat. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring cactus salvage, requiring noise-reduction devices, and avoiding land disturbance and road construction in desert washes, would reduce the likelihood of impacts on sensitive bat species.

Harquahala Southern Pocket Gopher. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for Harquahala southern pocket gopher. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on Harquahala southern pocket gopher.

Harris' Antelope Squirrel. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for Harris' antelope squirrel. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on Harris' antelope squirrel.

Kit Fox. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for kit fox. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on kit fox.

Little Pocket Mouse. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for little pocket mouse. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on little pocket mouse.

Sonoran Pronghorn. The proposed SEZ and surrounding area could provide potential habitat for Sonoran pronghorn. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparation of a mitigation and monitoring plan, would reduce the likelihood for impacts on Sonoran pronghorn.

Flat-tailed Horned Lizard. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for flat-tailed horned lizard. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparation of a mitigation and monitoring plan, would reduce the likelihood for impacts on flat-tailed horned lizard.

Rare Plants. Several rare plant species could occur in the proposed SEZ, including blue sand lily, California fan palm, Schott wire lettuce, and senita. None of these species is federally listed, but all are BLM sensitive and/or state-protected. The nature and types of potential impacts would be similar to those described in **Section 4.2.21**, Vegetation. Design features in **Appendix B**, such as requiring pre-construction surveys, establishing buffer areas, and preparation of a mitigation and monitoring plan, would reduce the likelihood for impacts on rare plants.

Desert Tortoise. There is no potential desert tortoise habitat within the proposed SEZ; however, the species has the potential to occur to the west and north of the proposed SEZ. As such, activities within the proposed SEZ could impact desert tortoise, mainly through reduction of potential movement corridor, noise, human presence, and increased vehicle traffic. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring noise reduction devices, timing activities to avoid sensitive periods for wildlife, and establishing buffer zones, would reduce the likelihood for impacts on desert tortoise.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Impacts would be similar to those described for Impacts Common to All Alternatives and Alternative 1. Locating energy development near existing transmission lines and utility corridors would indirectly protect special status species habitat from removal and fragmentation by reducing the need for new habitat disturbance associated with ROW development.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on special status species from the proposed Agua Caliente SEZ under Alternative 2 would be similar to those described for Alternative 1. However,

the maximum developed area within the proposed SEZ under Alternative 2 would be 6,770 acres, and one wash would pass through the eastern portion of the proposed SEZ (Township 5 South, Range 11 West, Section 5). As such, there would be fewer impacts on those special status species that rely on riparian and desert wash habitats.

Impacts from Alternative 3

Impacts from Load Offset REDA

Impacts would be to the same as those described for Impacts Common to All Alternatives and Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on special status species from the proposed Agua Caliente SEZ under Alternative 3 would be similar to those described for Alternative 1. However, the maximum developed area within the proposed SEZ under Alternative 3 would be 2,760 acres, and Alternative 3 would avoid all major washes. As such, there would be fewer impacts on those special status species that rely on riparian and desert wash habitats.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Impacts would be similar to those described for Impacts Common to All Alternatives and Alternative 1. The focus on protection of the groundwater supply in Alternative 4, however, would benefit special status species by maintaining water available to vegetation, which would thereby maintain wildlife habitats.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on special status species from the proposed Agua Caliente SEZ under Alternative 4 would be the same as those described for Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Impacts would be similar to those described for Impacts Common to All Alternatives and Alternative 1. However, development on lands identified for disposal in existing RMPs would reduce impacts on special status species, as these lands would not have special status species populations or habitats.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Impacts would be similar to those described for Impacts Common to All Alternatives and Alternative 1. Alternative 6 reduces impacts on special status species by combining the protective features of all the alternatives. This would maximize avoidance of special status species habitats and would reduce habitat disturbance and fragmentation.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on special status species from the proposed Agua Caliente SEZ under Alternative 6 would be to the same as those described for Alternative 2.

4.2.20 Travel Management

Evaluation Methodology, Resource Indicators, and Assumptions
BLM backcountry byways are the only access-focused designation that have been identified as "Areas with Known Sensitive Resources" (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]) and eliminated from consideration as a REDA.

Potential impacts on travel management could occur if reasonably foreseeable future actions were to result in long-term elimination or reduction of access.

Impacts Common to All Alternatives
Utility- and community-scale solar and wind energy development would temporarily impact travel management through increased traffic during construction. Unless a project reduces or eliminates access on designated or existing routes (or in areas where intensive cross-country use is allowed), operation of renewable energy projects is likely to have a negligible impact on travel management.

For both construction and operation, impacts on travel management would be reduced through the implementation of design features and BMPs. These include road improvements, maintaining proper traffic flows, speed limit reductions, the preparation of transportation and traffic management plans, and more (see **Appendix B**, Design Features and Best Management Practices).

Impacts from the No Action Alternative
Under the No Action Alternative, solar and wind energy development applications would continue to be processed on a case-by-case basis. Field offices would determine if wind and solar energy development would be in conformance with the travel management decisions in the relevant land use plan(s), but there would not be any guaranteed protection for travel management.

Impacts from Alternative 1
Impacts from Maximum REDA
Alternative 1 would result in more areas (321,500 acres) available to renewable energy development and a greater potential for conflict with travel management. However, by implementing design features and BMPs discussed above (and presented in detail in **Appendix B**, Design Features and Best Management Practices), impacts would be negligible.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed 20,600-acre Agua Caliente SEZ contains numerous routes that could be impacted by renewable energy development. Use on these routes is light and all are classified as "digital linear features" (i.e., linear features appearing on aerial photos that need to be field-checked and may not exist) or "non-motorized routes" by the Yuma Field Office RMP (BLM 2010g). Therefore, impacts on motorized travel are expected to be negligible. Although some routes within the proposed SEZ are classified as non-motorized routes, impacts on non-motorized travel are expected to be minor because the routes receive light use.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The Alternative 2 REDA would cover 218,600 acres, focusing on utility corridors and areas near transmission lines, which often provide access, especially for motorized vehicles. Concentrating development in these areas may conflict with access, though impacts would be mitigated through the use of design features and BMPs.

Impacts from Proposed Agua Caliente Solar Energy Zone

The types of impacts on travel management from the proposed SEZ under Alternative 2 would be similar to those described for Alternative 1, except the impacts would occur over a smaller area (6,770 acres).

Impacts from Alternative 3

Impacts from Load Offset REDA

Locating the 129,800-acre Alternative 3 REDA near cities, towns, and other load centers would likely result in development in areas where roads and trails receive higher use, thereby increasing impacts. Design features and BMPs would reduce but not eliminate impacts. Impacts would be most prominent during construction, when more vehicles are needed for transporting equipment and personnel.

Impacts from Proposed Agua Caliente Solar Energy Zone

The types of impacts on travel management from the proposed SEZ under Alternative 3 would be similar to those described for Alternative 1, except the impacts would occur over a smaller area (2,760 acres).

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The types of impacts under Alternative 4 would be the same as those described for Alternative 1. Designing the REDA around water conservation features would have negligible impact on travel management.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed SEZ under Alternative 4 would be the same size and location as under Alternative 1. Therefore, impacts would be the same as Alternative 4.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Under Alternative 5, the REDA would be composed of 43,700 acres identified for disposal in existing RMPs, which would not include areas highly valued for their access to adjacent lands. As a result, impacts on travel management would be negligible.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Locating the 237,100-acre Alternative 6 REDA near load centers would likely increase impacts on travel management because development would occur in areas where roads and trails receive more use. This, along with concentrating development in utility corridors and in close proximity to transmission lines, would increase the potential for development to conflict with access on existing routes. Design features and BMPs would reduce impacts, especially during construction, but locating development in areas less likely to experience high use levels would further limit impacts on travel management. Incorporating water conservation features similar to those under Alternative 4 would have negligible impact on travel management.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed SEZ under Alternative 6 would be the same size and location as under Alternative 2. Therefore, impacts would be the same as Alternative 2.

4.2.21 Vegetation

Evaluation Methodology, Resource Indicators, and Assumptions

This analysis addresses potential impacts on vegetation, riparian areas, and weeds from implementing the management actions under the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning vegetation are described in **Section 3.21**, Vegetation. This analysis focuses on solar and wind energy development that has the potential for physical disturbance of vegetation, loss of habitat, and loss or disturbance of riparian/wetland areas or their functioning condition in the planning area.

The effects of solar and wind energy development on vegetation and riparian areas may vary widely, depending on a variety of factors such as the type of soils, precipitation, soil moisture, topography, and plant reproductive characteristics. Surface disturbance disrupts the soil, removes existing vegetation, and can increase opportunities for noxious weeds and invasive species establishment, reducing vegetation diversity, production, and desirable plant cover.

Indirectly, this could reduce the ecological health of vegetative communities. Increasing surface disturbance could increase erosion rates and decrease riparian functioning conditions. Impacts on vegetation resources also vary

depending on the seral stage and composition of vegetation communities, which in Arizona can be generally classified as desert scrub, grassland, forest and woodland, and riparian areas. These classifications are based on the major species found in the vegetation types listed in **Chapter 3**, Affected Environment. Quantitative data were used, where possible, to calculate the acres of potentially affected vegetation communities. EPA Level III ecoregions were used to calculate impacts for the REDAs, while SWReGAP data (USGS National Gap Analysis Program 2004) were used to calculate impacts for the proposed Agua Caliente SEZ. In the absence of quantitative data, best professional judgment was used, and impacts are sometimes described using ranges of potential impacts or in qualitative terms, if appropriate.

Potential impacts on vegetation could occur if anticipated future actions as described in Chapter 2 were to result in the following:

- Removal of a vegetation community's unique attributes or ability to support other resource values.
- Acceleration of erosion and runoff, thereby altering the physical characteristics of terrestrial, wetland, and riparian vegetation.
- Replacement or substantial invasion of native communities with noxious and invasive weeds to the degree that such invasions cannot be successfully controlled.

The analysis is based on the following assumptions:

- Design features and BMPs in **Appendix B** would be required to avoid, minimize, or mitigate impacts on vegetation.
- The degree of impact attributed to any one disturbance or series of disturbances would be influenced by several factors, including location in the watershed; the type, time, and degree of disturbance; existing vegetation; precipitation; and mitigating actions applied to the disturbance.
- Noxious and invasive weeds would continue to be introduced and spread as a result of ongoing vehicle traffic in the REDA and proposed SEZ, recreational activities, wildlife and livestock grazing and movements, and surface-disturbing activities.
- Ecological health and ecosystem function depend on a number of factors, including vegetative cover, species diversity, nutrient cycling and availability, water infiltration and availability, and percent cover of weeds.
- Climatic fluctuation would continue to influence the health and productivity of plant communities on an annual basis.

- The proposed Agua Caliente SEZ would be fully developed, causing impacts on all of the vegetation within that area.

Impacts Common to All Alternatives

Impacts on vegetation from solar and wind energy development would vary depending on the project, location of proposed activities, and type of technology used. In general, impacts would occur during construction, operations and maintenance, and reclamation and abandonment. Impacts would be negligible during project siting and design, as there are no surface-disturbing activities associated with this phase. A summary of potential impacts on vegetation associated with utility-scale solar energy development and wind energy development is presented in the Draft Solar PEIS (BLM and DOE 2010, Section 5.10.1) and PEIS on Wind Energy Development (BLM 2005b, Section 5.9), respectively. The nature and type of vegetation impacts from non-utility-scale solar energy development would be similar to those from utility-scale solar but at a smaller magnitude. Potential impacts on vegetation associated with each phase of development are described below.

The greatest impacts on vegetation are likely to occur during the construction phase of development, as this is the phase with the greatest amount of surface-disturbing activities. During construction, both temporary and permanent impacts on vegetation would occur from clearing for access roads, staging areas, placement of solar or wind facilities (e.g., PV panels, wind turbines), associated facilities (e.g., transformers, maintenance buildings), and transmission lines. Native vegetation communities would be destroyed, and these may include sensitive communities such as riparian areas and wetlands.

Vegetation removal would also leave barren areas that would be susceptible to the introduction or spread of noxious weeds and invasive plant species. In some cases, invasive species may completely displace native species. Other adverse impacts associated with the spread of invasive species may include a decrease in biological diversity of ecosystems; a reduction in water quality and availability for wildlife species; a decrease in the quality of habitats for wildlife; alterations in habitats needed by threatened and endangered species; and health hazards, because some species are poisonous to humans, wildlife, and livestock.

Other impacts on vegetation resulting in changes to plant community composition, plant productivity, and plant health include the following:

- Soil compaction, which reduces water infiltration and soil aeration and may affect plant health;
- Habitat fragmentation (see **Section 4.2.6**, Fish and Wildlife);
- Increased erosion and sedimentation, which would reduce soil availability and could impact the health of terrestrial, riparian, and wetland vegetation;

- Fugitive dust, which could affect photosynthesis and plant productivity;
- Changes to the hydrologic regime caused by grading or facility placement, which could cause a reduction in the duration, frequency, or extent of inundation or soil saturation;
- Increased risk of fire caused by equipment and workers on-site; and
- Contamination, caused by spills of fuel or other hazardous materials.

It is anticipated that impacts on vegetation communities would be reduced through the use of as the design features and BMPs in **Appendix B** that would require projects to be planned to avoid, minimize, or mitigate impacts on aquatic habitats, wetland habitats, other special aquatic sites, unique biological communities, and crucial wildlife habitats. The design features also require preparation of a weed control plan that would be implemented to reduce the likelihood of weed introduction and spread. Another requirement includes reclamation and revegetation of those areas that are not needed for facility operation, such as temporary access roads and staging areas. The success of revegetation efforts may vary, as many of the desert communities within Arizona are sensitive to disturbance and may take decades to recover. Fewer impacts on vegetation would occur during the operations and maintenance phase, as there would be few surface-disturbing activities. For solar projects, vegetation would likely remain cleared or maintained at a low stature within fenced areas throughout the life of the project. Since wind projects generally have a smaller permanent footprint than solar projects, fewer areas would need to be cleared and revegetated. The likelihood of weed invasion during operations/maintenance is lower than during construction, but workers and vehicles accessing sites could still introduce or spread weeds into developed areas over time. Design features (**Appendix B**, Design Features and Best Management Practices), such as implementing vegetation management and weed control plans, would help to reduce impacts.

Impacts from reclamation and abandonment would be similar to those described for construction of projects, as surface-disturbing activities would occur and vehicles and personnel on-site would increase for a period of time. After all facilities are removed, the affected areas would be reclaimed, and vegetation and habitats would be restored. Design features (**Appendix B**), such as implementing a decommissioning and site reclamation plan, would help to reduce impacts.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind development by statute, regulation, or orders would remain

excluded, and administratively excluded areas would be assessed based on management in local land use plans. The number of acres of vegetation that could be disturbed is unknown; however, impacts would be site-specific and similar to the types of impacts described for vegetation in Impacts Common to All Alternatives. However, without a programmatic approach to solar and wind energy development, planning for vegetation may be fragmented and segregated, which often increases impacts.

Impacts from Alternative 1

Impacts from Maximum REDA

The nature and type of impacts on vegetation likely to occur from Alternative 1 would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 1 are presented in **Table 4-14**, Potential Ecoregion Impacts in the REDA for Alternative 1. Sonoran Basin and Range and Mojave Basin and Range are the ecoregions that would be most likely to be affected on lands within the REDA planning area.

Table 4-14
Potential Ecoregion Impacts in the REDA for Alternative 1

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	3,500
Arizona/New Mexico Plateau	56,100
Chihuahuan Desert	100
Madrean Archipelago	7,300
Mojave Basin and Range	81,100
Sonoran Basin and Range	172,900
Colorado Plateau	600

Source: EPA 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts on vegetation likely to occur from Alternative 1 within the proposed Agua Caliente SEZ would be similar to those described for Impacts Common to All Alternatives. Vegetation communities that would be potentially impacted under all alternatives in the proposed SEZ are presented in **Table 4-15**, Potential Vegetation Impacts in the Proposed SEZ by Alternative. Sonora-Mojave Creosotebush-White Bursage Desert Scrub is the community that would be most likely to be affected in the SEZ. Other potentially affected communities include Invasive Southwest Riparian Woodland and Shrubland, Sonoran Paloverde-Mixed Cacti Desert Scrub, and Agricultural Lands.

Table 4-15
Vegetation Present in the Proposed SEZ by Alternative

SWReGAP Cover Type	No Action Alternative (acres)	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)	Alternative 5 (acres)	Alternative 6 (acres)
Sonora-Mojave Creosote-bush–White Bursage Desert Scrub	0	20,260	6,610	2,640	20,260	0	6,610
Invasive Southwest Riparian Woodland and Shrubland	0	240	110	90	240	0	110
Sonoran Paloverde–Mixed Cacti Desert Shrub	0	70	20	20	70	0	20
Agriculture	0	20	30	20	20	0	30

Source: USGS National Gap Analysis Program 2004

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of impacts on vegetation likely to occur under Alternative 2 would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 2 are presented in **Table 4-16**, Potential Ecoregion Impacts in the REDA for Alternative 2. The ecoregions most likely to be affected would be the same as those described for Alternative 1. Locating energy development near existing transmission lines and utility corridors would indirectly protect vegetation from removal and fragmentation by reducing the need for vegetation removal associated with new ROW development.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts on vegetation likely to occur from Alternative 2 within the proposed Agua Caliente SEZ would be to the same as those described for Impacts Common to All Alternatives. Vegetation communities that would be potentially impacted under all alternatives in the proposed SEZ are presented in **Table 4-15**, Vegetation Present in the Proposed SEZ by Alternative. Sonora-Mojave Creosotebush-White Bursage Desert Scrub is the community that would be most likely to be affected in the SEZ under Alterative 2.

Other potentially affected communities include Invasive Southwest Riparian Woodland and Shrubland, Sonoran Paloverde-Mixed Cacti Desert Scrub, and Agricultural Lands.

Table 4-16
Potential Ecoregion Impacts in the REDA for Alternative 2

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	0
Arizona/New Mexico Plateau	7,500
Chihuahuan Desert	100
Madrean Archipelago	5,700
Mojave Basin and Range	76,700
Sonoran Basin and Range	127,900
Colorado Plateau	600

Source: EPA 2011b

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and type of impacts on vegetation likely to occur from Alternative 3 within the REDA would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 3 are presented in **Table 4-17**, Potential Ecoregion Impacts in the REDA for Alternative 3. Sonoran Basin and Range and Arizona/New Mexico Plateau are the ecoregions that would be most likely to be affected within the REDA planning area.

Table 4-17
Potential Ecoregion Impacts in the REDA for Alternative 3

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	200
Arizona/New Mexico Plateau	8,400
Chihuahuan Desert	0
Madrean Archipelago	5,600
Mojave Basin and Range	3,000
Sonoran Basin and Range	112,000
Colorado Plateau	600

Source: EPA 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts on vegetation likely to occur from Alternative 3 within the proposed Agua Caliente SEZ would be the same as those described for Impacts Common to All Alternatives. Vegetation communities that would be potentially impacted under all alternatives in the proposed SEZ are presented in

Table 4-15. Sonora-Mojave Creosotebush-White Bursage Desert Scrub is the community that would be most likely to be affected in the SEZ. Other potentially affected communities include Invasive Southwest Riparian Woodland and Shrubland, Sonoran Paloverde-Mixed Cacti Desert Scrub, and Agricultural Lands.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The nature and type of impacts on vegetation likely to occur from Alternative 4 would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 4 are presented in **Table 4-18**, Potential Ecoregion Impacts in the REDA for Alternative 4. The ecoregions most likely to be affected would be the same as those described for Alternative 1. The focus on protection of the groundwater supply in Alternative 3 would maintain water available to vegetation, which would thereby maintain the composition and structure of vegetation communities.

Table 4-18
Potential Ecoregion Impacts in the REDA for Alternative 4

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	3,500
Arizona/New Mexico Plateau	56,100
Chihuahuan Desert	100
Madrean Archipelago	7,300
Mojave Basin and Range	81,100
Sonoran Basin and Range	172,900
Colorado Plateau	600

Source: EPA 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts on vegetation likely to occur from Alternative 4 within the proposed Agua Caliente SEZ would be the same as those described for Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

The nature and type of impacts on vegetation likely to occur from Alternative 5 would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 5 are presented in **Table 4-19**, Potential Ecoregion Impacts in the REDA for Alternative 5. Sonoran Basin and Range and Mojave Basin and Range are the communities that would be most likely to be affected within the REDA under Alternative 5.

Table 4-19
Potential Ecoregion Impacts in the REDA for Alternative 5

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	0
Arizona/New Mexico Plateau	0
Chihuahuan Desert	0
Madrean Archipelago	3,800
Mojave Basin and Range	11,100
Sonoran Basin and Range	28,200
Colorado Plateau	600

Source: EPA 2011b

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

The nature and type of impacts on vegetation likely to occur from Alternative 6 would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 6 are presented in **Table 4-20**, Potential Ecoregion Impacts in the REDA for Alternative 6. The ecoregions most likely to be affected would be the same as those described for Alternative 1. Alternative 6 reduces impacts on vegetation by combining the protective features of the other action alternatives. This would reduce new vegetation disturbance and removal.

Table 4-20
Potential Ecoregion Impacts in the REDA for Alternative 6

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	200
Arizona/New Mexico Plateau	12,400
Chihuahuan Desert	100
Madrean Archipelago	6,300
Mojave Basin and Range	76,700
Sonoran Basin and Range	140,700
Colorado Plateau	600

Source: EPA 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts on vegetation likely to occur from Alternative 6 within the proposed Agua Caliente SEZ would be similar to those described for Impacts Common to All Alternatives. Vegetation communities that would be potentially impacted under all alternatives in the proposed SEZ are presented in **Table 4-15**. Sonora-Mojave Creosotebush-White Bursage Desert Scrub is the community that would be most likely to be affected in the SEZ. Other potentially affected communities include Invasive Southwest Riparian Woodland

and Shrubland, Sonoran Paloverde-Mixed Cacti Desert Scrub, and Agricultural Lands.

4.2.22 Visual Resources

This section analyzes impacts on visual resources as a result of identifying lands as the REDA and each proposed Agua Caliente SEZ, as well as indirect impacts from solar or wind development.

Project-specific analysis will be required to determine actual impacts on site-specific visual resource factors of scenic quality, sensitivity levels, and distance zones. Without site-specific project proposals, the proposed REDA lands for each alternative were overlaid with the four VRI components (i.e., scenic quality, sensitivity levels, distance zones, and VRI classification). Where proposed REDA lands overlap with C-ranked scenic quality lands, there would be no impact on scenic quality because the lands cannot move into a lower category. Similarly, where REDA lands overlap with low-sensitivity lands or VRI Class IV lands, there would be no impact on that component of visual resources because lands cannot move into a lower category.

For this analysis, it is assumed that lands within the foreground/middleground distance zone that overlap REDA would remain in that category, as new infrastructure, including roads, could be developed to access renewable energy projects. While there would not be an impact on the foreground/middleground distance zone in terms of changing distance zones, these lands are most seen by viewers because they are the closest to roads or trails. As such, changes to the landscape within this zone can be perceived has having more of an impact than changes in the background or seldom-seen distance zone.

While the discussion that follows focuses in quantitative terms on impacts on visual resources within the REDA footprint, impacts on visual resources could be experienced beyond the location of development. As such, representative sensitive areas within five miles (the distance amounting to the foreground/middleground distance zone) of REDA lands were selected to indicate the visual impact. The viewshed from the sensitive areas may be impacted by solar or wind energy development within the REDA. Structures and development in the foreground-middleground of the viewshed are the most prominent and are viewable to the greatest number of people. Special designation areas identified as sensitive receptors are those where visual resources: 1) have been identified as a value to be protected in that area; or 2) are inherent to their uniqueness. This analysis is qualitative and does not take into account topographic, vegetation, or other features that might shield REDA lands from view. It also does not take into account the number of potential viewers from each of the sensitive receptors. It is recognized that some areas might be heavily visited, while others may have few visitors. All development would be subject to site-specific NEPA analysis, and appropriate sensitive

receptors would be identified and evaluated at that time. Representative sensitive receptors on BLM-administered lands are:

- Wilderness areas;
- WSAs;
- ACECs;
- National monuments;
- National scenic and historic trails; and
- National conservation areas.

Special designation areas on non-BLM-administered land identified as sensitive receptors are:

- NPS lands (includes national parks, wilderness areas, national monuments, and NRAs);
- National scenic and historic trails;
- National monuments; and
- Byways.

Preliminary viewshed analyses were conducted to identify which lands surrounding each proposed Agua Caliente SEZ are visible from each SEZ. Two viewshed analyses were conducted, each with a different height representative of project elements associated with potential solar energy technologies, including solar dishes and power blocks for CSP technologies (38 feet) and tall solar power towers (650 feet). These heights were selected based on methodology from the Solar PEIS (BLM and DOE 2010).

The viewshed analysis did not account for the presence of vegetation or structures that might screen views of the landscape. However, in most cases, this introduced little error, because most of the land within the viewshed of each proposed SEZ is devoid of vegetation or structures of sufficient height to screen solar facilities from view.

One target point was used as a potential location of a solar structure. This target point was located in the center of each proposed Agua Caliente SEZ. In addition to its geographical location on the ground, the target point can represent its own height, as well as the height of a person viewing it. Heights representative of the potential solar energy technologies (see above) were used as target heights. This resulted in two separate viewshed analyses for each proposed SEZ, each representing a potential solar energy technology.

Each viewshed was then overlain on the data layers representing the different sensitive receptors, which include ACECs, BLM wilderness, NCAs, WSAs,

national scenic and historic trails, national monuments, NPS land, byways, and VRM Class I areas. The Juan Bautista de Anza National Historic Trail, Sears Point ACEC, and Eagletail Mountains Wilderness may be located within the viewshed of each proposed Agua Caliente SEZ.

Also included in this analysis are photographs from various key observation points (KOPs) around the proposed Agua Caliente SEZ analysis area. Some of the points chosen are on sensitive resource areas, such as on lands managed to maintain wilderness, along the Juan Bautista de Anza National Historic Trail, and on Sears Point. Photographs were taken from other KOPs, which were spread throughout the proposed Agua Caliente SEZ. **Figure 4-2**, Key Observation Points of Proposed Agua Caliente SEZ: Photographs of KOPs 001-005, and **Figure 4-3**, Key Observation Points of Proposed Agua Caliente SEZ: Photographs of KOPs 006-009, provide photos taken from KOPs of the proposed Agua Caliente SEZ analysis area.

Finally, the VRI class was compared to the VRM class of the proposed Agua Caliente SEZ in order to compare the current condition of area visual resources to the level of landscape modification allowed by the area's assigned VRM class. Note that this analysis could not be performed for REDA lands because VRI data are unavailable on a state-wide level.

Impacts Common to All Alternatives

Because of the experiential nature of visual resources, the human response to visual changes in the landscape cannot be quantified even though the visual changes associated with solar and wind development can be described (BLM and DOE 2010). There is, however, some commonality in individuals' experiences of visual resources, and while it may not be possible to quantify subjective experience and values, it is possible to systematically examine and characterize commonly held visual values and to reach consensus about visual impacts and their trade-offs. The BLM's VRM procedures, discussed in **Section 3.22**, Visual Resources, provide a means of describing visual impacts systematically and of evaluating their impact on the scenic qualities of affected landscapes, so that defensible decisions about the relative worth and disposition of visual resources relative to competing resource demands can be made (BLM 1984). A discussion of factors that influence an individual's perception of visual impacts can be found in the Draft Solar PEIS (BLM and DOE 2010, Chapter 5, pp. 5-160 to 5-161).

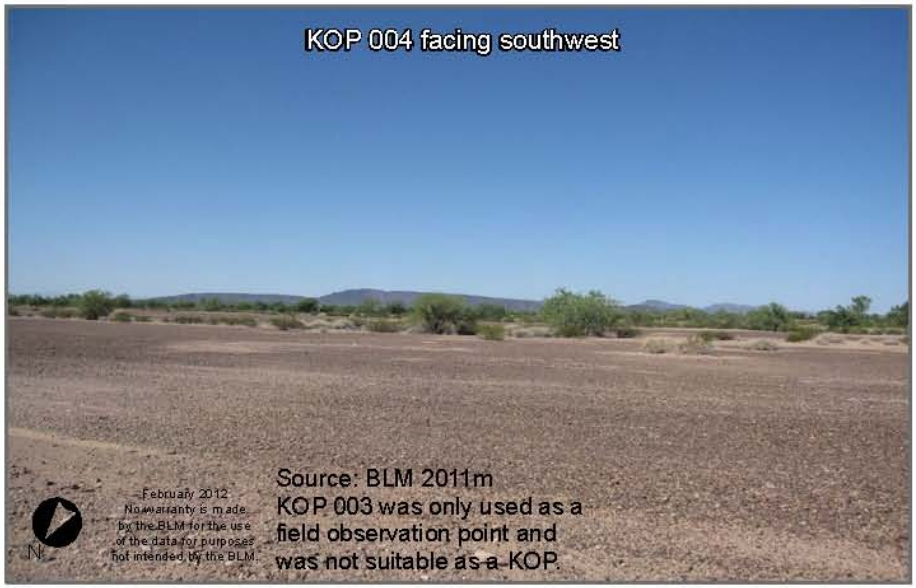
Visual impacts depend upon the type and degree of visual contrasts introduced to an existing landscape. Where modifications repeat the general forms, lines, colors, and textures of the existing landscape, the degree of visual contrast is lower, and the impacts are generally perceived less negatively. Where modification introduces pronounced changes in form, line, color, and texture, the degree of contrast is greater, and impacts are often perceived more negatively.

Key Observation Points of Proposed Agua Caliente SEZ: Photographs of KOPs 001-005

Please see Figure 4-9 for KOP locations.









Key Observation Points of Proposed Agua Caliente SEZ: Photographs of KOPs 006-009

Please see Figure 4-9 for map of KOP locations.









Visual impacts associated with wind and solar energy development can be produced through a range of direct and indirect actions or activities, including:

- Vegetation and landform alterations;
- Additions of structures, including solar collector/reflector arrays, buildings, and other ancillary facilities;
- Additions or upgrades to roads;
- Additions or upgrades to utilities and/or ROWs, such as expanding ROW width, adding electric transmission lines, which results in larger towers, or upgrading transmission voltage rating;
- Vehicular activity;
- Dust, water vapor plumes, and other visible emissions; and
- Light pollution.

A detailed discussion of visual changes likely to occur as a result of siting and design, construction, operation and maintenance, and reclamation and abandonment of utility-scale solar energy development, including technology-specific impacts, can be found in the Draft Solar PEIS (BLM and DOE 2010, Chapter 5, pp. 5-164 to 5-191). The nature and type of visual changes likely to occur from non-utility-scale solar energy development would be similar but of smaller magnitude.

A detailed discussion of visual changes likely to occur as a result of siting and design, construction, operation and maintenance, and reclamation and abandonment of wind energy development can be found in the Wind Energy Development PEIS (BLM 2005b, Chapter 5, pp. 5-90 to 5-96).

Solar and wind energy projects are being concentrated in VRM Class IV areas where land use plan visual objectives allow for major level of visual modifications and avoids VRM Class I, II, and III where VRM Class objectives are more restrictive and protective of visual values. There are exceptions, though, were pre-disturbed lands (nominated sites) happen to be located within VRM Class II and III areas. There are 8 nominated sites within VRM Class II that would cover 1,650 acres (less than 1 percent of the total VRM II acreage), and 21 nominated sites within VRM Class III that would cover 20,850 acres (less than 1 percent of the total VRM Class III acreage).

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind energy development would continue to be authorized on a case-by-case basis. In areas identified as ROW exclusions, solar and wind energy development would not be permitted, thereby maintaining the surrounding viewshed. In ROW avoidance areas, solar and wind energy development would only be authorized if it is compatible with the purpose for which the area was identified for avoidance, and the

development is not otherwise feasible on lands outside the avoidance area. Under such circumstances, development would still be required to meet the applicable VRM class assigned to the land on which the project would be developed. As such, visual resources would be protected to the extent required by the VRM class. VRM Class I areas would be protected more than VRM Class IV areas by allowing less landscape modification.

Impacts Common to All Action Alternatives

Impacts from REDA

The nature and type of impacts from solar and wind energy development are described above in Impacts Common to All Alternatives. VRM Class I, II, and III lands have been identified as 'Areas with Known Sensitive Resources' (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]) and have been eliminated from consideration as a REDA. Solar and wind energy development would meet the objectives of VRM Class IV areas. However, all or portions of 8 nominated sites totaling 1,650 acres are in VRM Class II areas (less than 1 percent of the total BLM Arizona VRM II acreage), and all or portions of 21 nominated sites totaling 20,850 acres are in VRM Class III areas (less than 1 percent of the total BLM Arizona VRM Class III acreage). Solar and wind energy development is not generally compatible with VRM Class II or III objectives. Some low-profile solar development may be compatible with VRM Class III objectives if developed so that activities do not dominate the casual observer's view.

Even in VRM Class IV areas, every attempt should be made to minimize the impact of solar and wind development through careful location, minimal disturbance, and repetition of the basic landscape elements. To that end, some plans that may be required as part of project development, as discussed in **Section 2.3.2**, Elements Common to All Action Alternatives, could include elements that provide some visual resources mitigation. Plans include:

- Access Road Siting and Management Plan;
- Compensatory Mitigation and Monitoring Plan;
- Decommissioning and Site Reclamation Plan;
- Glint and Glare Assessment, Mitigation, and Monitoring Plan; and
- Lighting Plan.

In addition, the following management actions, also discussed in **Section 2.3.2**, Elements Common to All Action Alternatives, would provide some protection of visual resources by minimizing visual disturbance or concentrating development in already-disturbed areas:

- To protect sacred sites and portions of historic trails that are potentially eligible for listing on the NRHP from visual intrusion and to maintain the integrity of the historic cultural setting, the

BLM could require that surface disturbance be restricted or prohibited within the viewshed of a sacred site or within the viewshed of the trail along those portions of the trail for which eligibility is tied to the visual setting.

- Consolidation of access and other supporting infrastructure will be required for single projects and for cases in which more than one project is close to another to maximize efficient use of public land.

- Disturbed lands would be reallocated as preferred development areas for renewable energy development.

In any case, where REDA lands (including nominated sites) overlap VRI Class II or III lands, scenic quality B-ranked lands, lands with high or medium sensitivity to landscape changes, or lands within the background or seldom seen distance zone, there is a potential for change to that visual resources component. Under all action alternatives, none of the proposed REDA overlaps scenic quality A landscapes. There is also no overlap with VRI Class I lands because VRI Class I is only assigned to special areas, such as designated wilderness, which were identified as 'Areas with Known Sensitive Resources' (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]) and eliminated from consideration as a REDA.

Impacts on Scenic Quality: Solar and wind energy development has the potential to add cultural modifications to an area, which can then change the elements of vegetation and color by removing vegetation or changing the predominant vegetation type over time. The size and type of facility would be the main factor in how cultural modifications affect vegetation and color and ultimately contribute to a scenic quality change.

Impacts on Sensitivity: Solar or wind energy development is unlikely to impact the sensitivity of the area. However, solar or wind energy development in high- or medium-sensitivity areas may be more highly scrutinized or opposed by the public, as these areas have been identified as places of higher public concern for scenic quality.

Impacts on Distance Zone: Solar and wind energy development have the potential to change the background and seldom-seen distance zones by building new access roads to the facility. If these roads become utilized by the public, there is more opportunity for the casual observer to view the facilities for a longer period of time. However, with the BLM trending towards designating routes for specific uses, roads created strictly for access purposes are not likely to be designated for public use. Because of this, it is assumed that areas within the background and seldom-seen distance zones would remain as such.

Impacts on VRI Classification: A change in any of the three visual resource inventory components could change the VRI classification. Because proposed

actions in this EIS are not expected to impact distance zones or sensitivity, changes to VRI classification would come from impacts on scenic quality, as previously discussed. Changing scenic quality B-ranked lands in the foreground/middleground distance zone could result in a change in VRI Class from either Class II to Class III in high-sensitivity areas, or from Class III to Class IV in medium-sensitivity areas.

The discussion under each alternative focuses on the potential direct impact on scenic quality B-ranked lands in the foreground/middleground distance zone where there is overlap with REDA. As previously discussed, VRI data for the Tucson Field Office were unavailable at the time of this analysis. Proposed REDA occurring in the Tucson Field Office is included in this analysis, but any potential visual conflicts are not included in the acreages. The nature and type of impacts would be the same as those previously discussed.

Impacts from Proposed Agua Caliente Solar Energy Zone

As noted in **Section 3.22.2**, Visual Resources, Agua Caliente SEZ Affected Environment, the current VRI for the proposed SEZ is Class III and has a scenic quality rating of B, has a sensitivity rating of medium, and is located in the foreground/middleground distance zone. Since the VRI was developed, however, First Solar has begun constructing a new 290-MW solar energy facility on adjacent private land (retired agricultural lands), which has added a new visual intrusion to the area in addition to the transmission line and railroad. Due to these existing and anticipated landscape modifications, the sensitivity rating for the area may have already been impacted by cultural modifications and contrast in form, line, color, and texture. It is unlikely that additional solar development in the proposed Agua Caliente SEZ would result in additional impacts on scenic quality beyond what exists and is anticipated on adjacent private lands.

The Juan Bautista de Anza National Historic Trail sits low in the valley, and vegetation blocks the view of the proposed Agua Caliente SEZ, particularly along the portion of the trail to the southwest of the proposed SEZ. While the viewshed analysis projects that the proposed Agua Caliente SEZ might be visible from the trail, it is unlikely to be seen along most, if not all, of the trail, due to tall vegetation blocking the view. Recreation in the area is generally dispersed; there are no developed recreation sites. It is a seasonally popular hunting area. As such, the casual observer is likely to be either a hunter or an employee of the existing solar energy facility.

Impacts from Alternative 1

Impacts from Maximum REDA

The nature and type of impact on visual resources would be the same as those described under Impacts Common to All Action Alternatives. Under Alternative 1, approximately 35,600 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA, which accounts for 11 percent of REDA lands under this alternative (BLM 2011a, 2011b).

Alternative 1 provides the most opportunity for sensitive receptors to be impacted by solar and wind energy development. **Table 4-21**, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternatives 1 and 4, shows the total number of sensitive receptors and associated acreages within five miles of a REDA on BLM-administered land. Solar or wind energy development in the proposed REDA surrounding these areas would result in modifications to the landscape that, if visible from these areas, would impact the visual resource that is either: 1) identified as a value to be protected in that area; or 2) inherent to the uniqueness of the area.

Table 4-21
Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternatives 1 and 4

Sensitive Receptor	Number of Areas	Acres*
ACECs	19	41,600
BLM Wilderness	28	69,900
National Conservation Areas	2	100
Wilderness Study Areas	1	800
National Scenic and Historic Trails	3	22,000
National Monuments	5	31,200
NPS Land (includes National Parks, Wilderness, National Monuments, and NRAs)	5	16,200
Byways	2	40

Source: BLM 2011a, 2011b
*Acres may overlap one another if sensitive receptor is within five miles of another. The sum of the acres in this table is greater than the total acres of sensitive receptors within five miles of REDA on BLM lands.

Five percent or less of each of the special designation areas listed in Table 4-21 would be within five miles of the proposed REDA on BLM-administered land. The viewsheds of these special areas have the potential to be impacted by solar and wind energy development, as described under Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 1, the Yuma Field Office RMP would be amended so that the proposed Agua Caliente SEZ would be managed as VRM Class IV instead of VRM Class III. This would result in a 21,030-acre (4-percent) reduction in VRM Class III areas, while increasing VRM Class IV areas by the same amount, over two times the original acreage (**Table 4-22**, Proposed Changes to Yuma Field Office VRM Classes).

Table 4-22
Proposed Changes to Yuma Field Office VRM Classes

VRM Class	Current		Proposed	
	Acres	Percent	Acres	Percent
I *(all alternatives)*	167,800	13	167,800	13
II *(all alternatives)*	618,600	47	618,600	47
III	512,400	39		
Alternatives 1, 3, & 4			*491,370*	*37*
Alternatives 2 & 6			*505,630*	*38*
Alternative 5			*509,640*	*39*
IV	19,200	1		
Alternatives 1, 3, & 4			*40,230*	*3*
Alternatives 2 & 6			*25,970*	*2*
Alternative 5			*21,960*	*2*
Total	**1,318,000**		**1,318,000**	

Source: BLM 2010g

Solar and wind energy development would be more compatible with VRM Class IV objectives than with VRM Class III objectives, as more modifications to the landscape would be allowed under VRM Class IV.

Viewshed analyses illustrate how CSP technology might be visible from areas with significant wilderness and cultural resources. Areas taken into account were the Juan Bautista de Anza National Historic Trail, Sears Point ACEC, Woolsey Peak Wilderness, Signal Mountain Wilderness, and Eagletail Mountains Wilderness. Analyses were conducted assuming CSP technology was placed at the center of the proposed Agua Caliente SEZ. The height of potential CSP technology could be anywhere between 650 feet and 25 feet. As such, 650 feet and 38 feet were selected as sample heights for analysis. **Figures 4-4** through **4-8** show the impact CSP technology 650 and 38 feet tall, respectively, would have on the viewshed of the above areas. The analyses assume ideal conditions (e.g., no haze, dust, vegetation, or other obstructions) are present, allowing visitors to be able to see clearly across the landscape. All analyses were conducted using the largest Agua Caliente SEZ footprint. As such, these analyses are relevant for all alternatives.

Figure 4-4, Viewshed Analysis of Proposed Agua Caliente SEZ Analysis Area: Potential Concentrated Solar Power Technology 650 Feet Tall, shows a viewshed analysis based on the presence of CSP technology 650 feet tall placed in the center of the proposed Agua Caliente SEZ. Within five miles of the viewpoint, there are no significant cultural or wilderness areas. Within 15 miles of the viewpoint, the CSP technology could be visible from many points along the Juan Bautista de Anza National Historic Trail, as well as from portions of the Sears Point ACEC. Within 25 miles, the viewpoint could be visible from portions of the Juan Bautista de Anza National Historic Trail and also from parts of the Eagletail Mountains Wilderness.

Viewshed Analysis of Proposed Agua Caliente SEZ: Potential Concentrated Solar Power Technology 650 Feet Tall

This analysis assumes a potential concentrated solar power technology that is 650 feet tall. Infrastructure from a potential 650-foot-tall tower would be visible from Sears Point ACEC, the Anza Trail, and may be visible from the Eagletail Mountain Wilderness, Signal Mountain Wilderness and Woolsey Peak Wilderness.

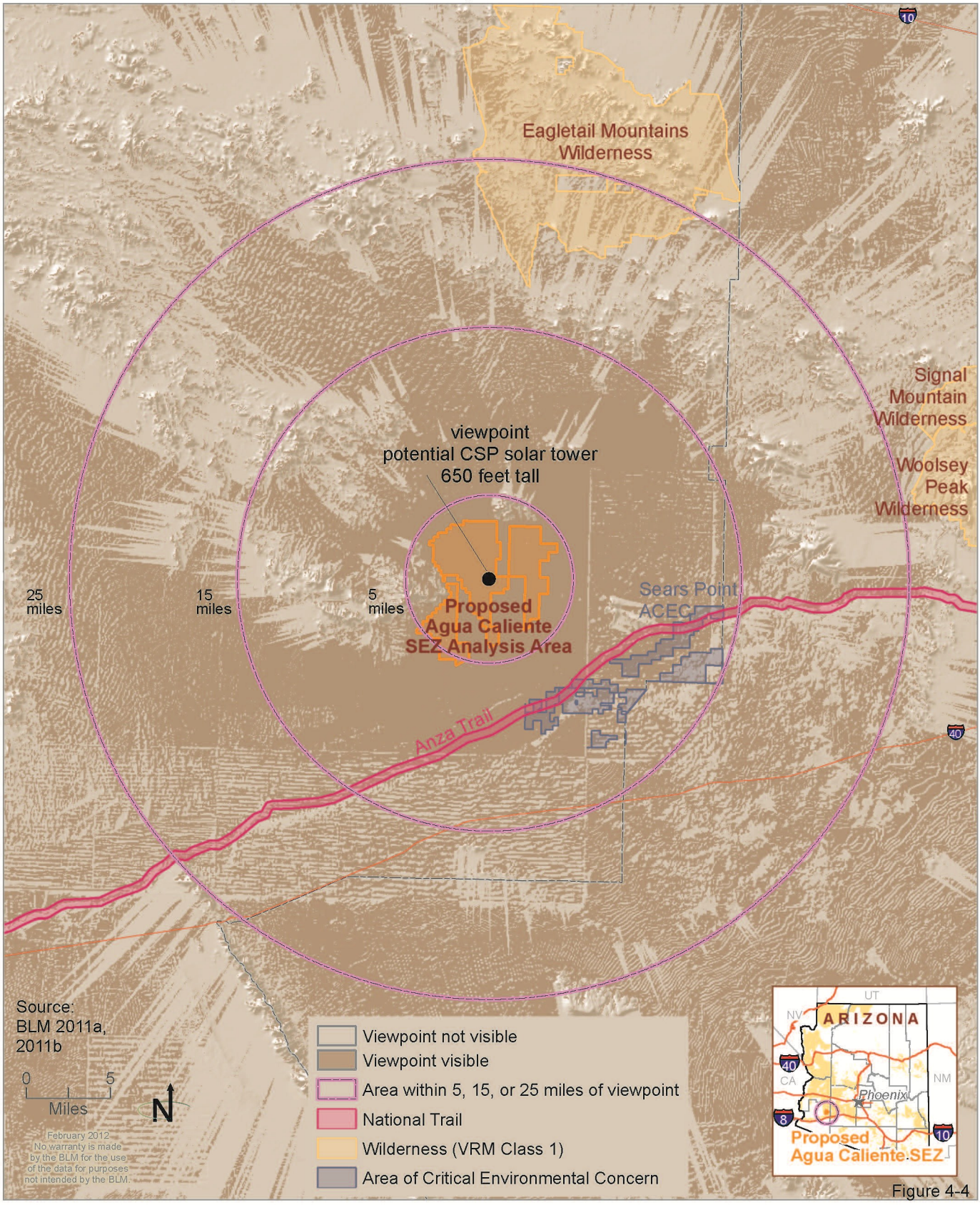
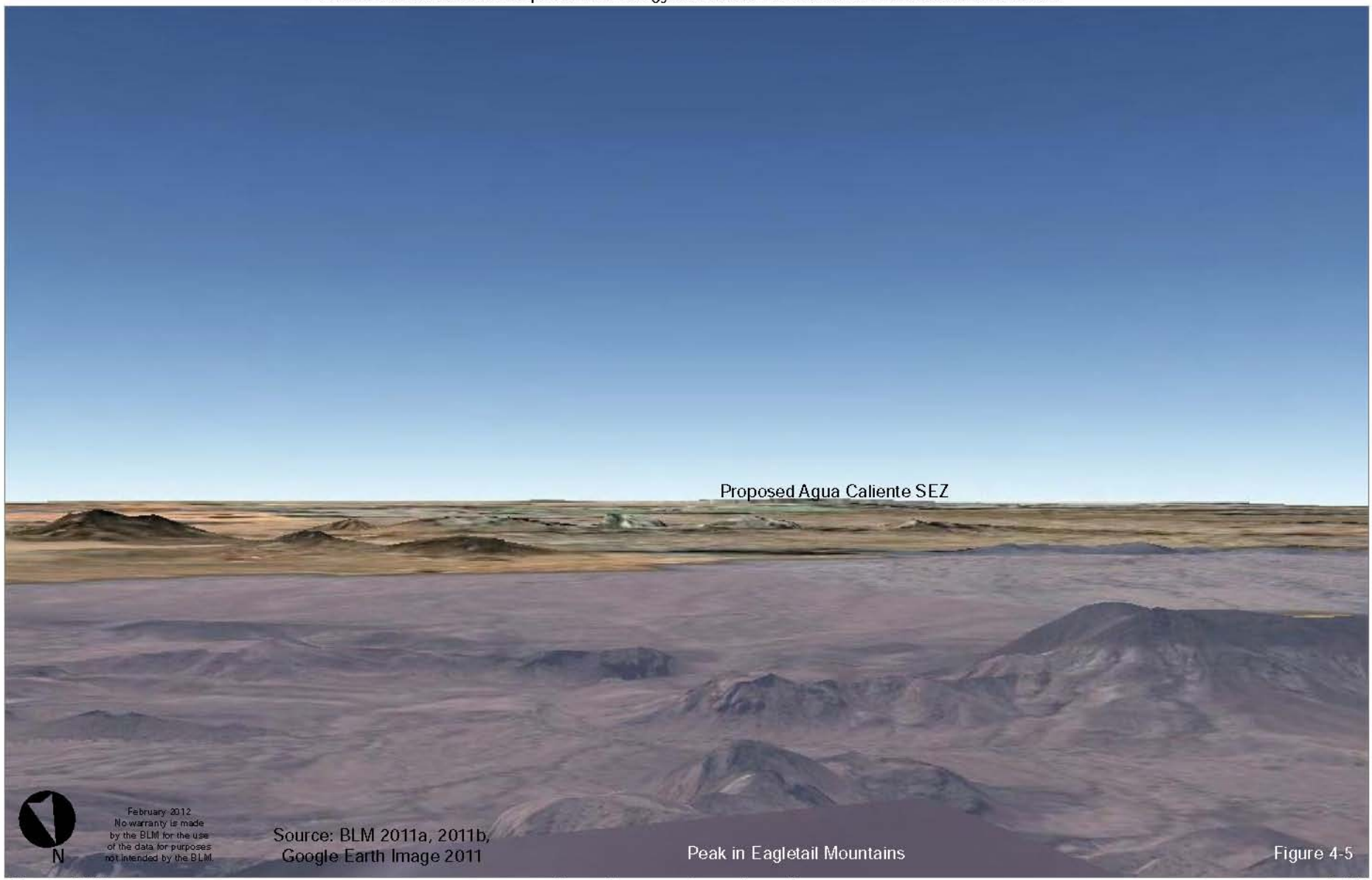


Figure 4-4

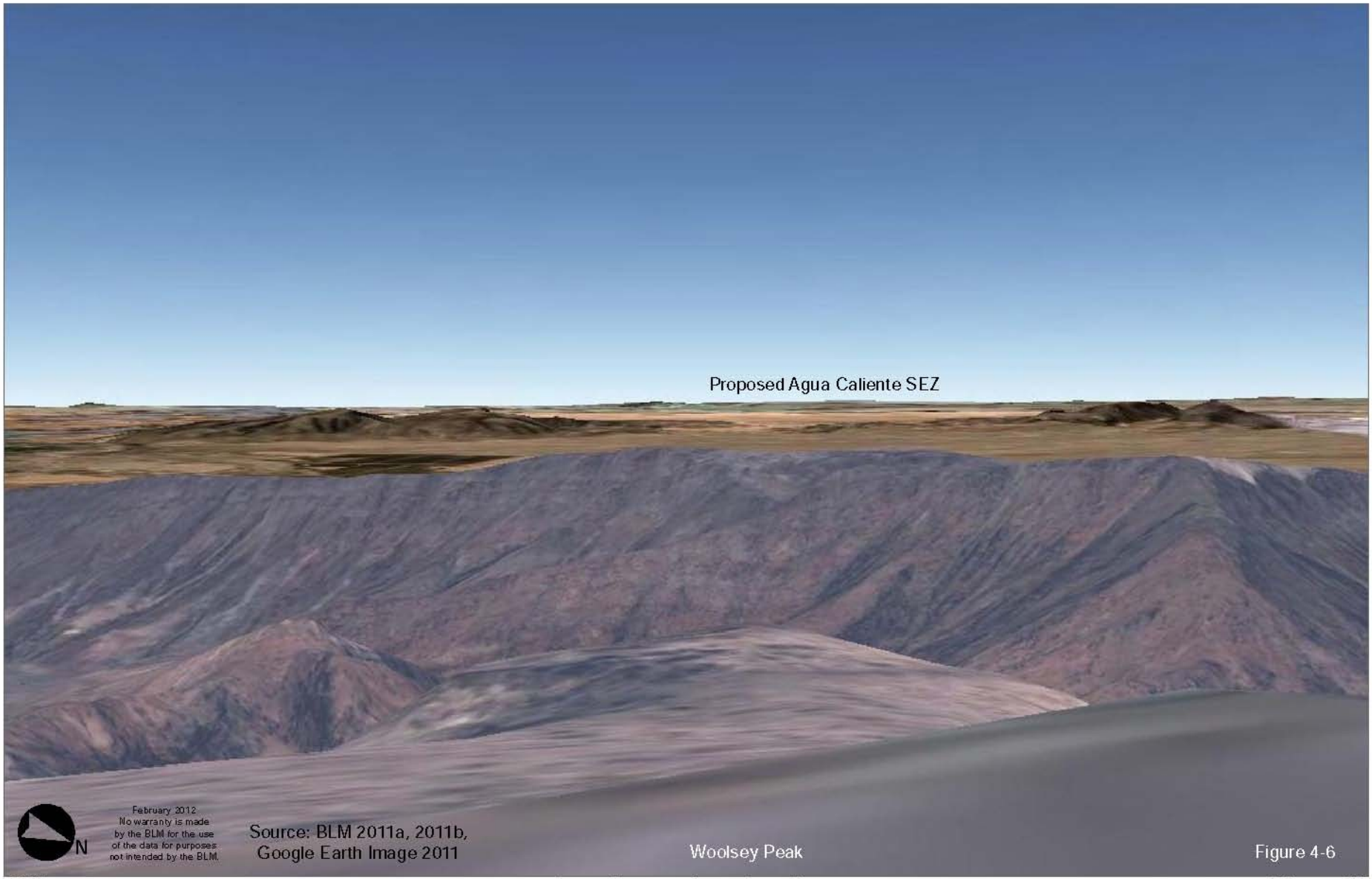
Visual Simulation of Eagletail Mountain Wilderness: Potential Concentrated Solar Power Technology 650 Feet Tall

View from a peak in the Eagletail Mountains looking south towards the proposed Agua Caliente SEZ. Distance to SEZ: 27 miles.
Potential concentrated solar power technology 650 feet tall is not visible in this visual simulation.



Visual Simulation of Woolsey Peak and Signal Mountain Wilderness: Potential Concentrated Solar Power Technology 650 Feet Tall

View from Woolsey Peak and Signal Mountains Wilderness looking west towards the proposed Agua Caliente SEZ. Distance to SEZ: 36 miles. Potential concentrated solar power technology 650 feet tall is not visible in this visual simulation.



Viewshed Analysis of Proposed Agua Caliente SEZ: Potential Concentrated Solar Power Technology 38 Feet Tall

This analysis assumes a concentrated solar power technology that is 38 feet tall. Infrastructure from a potential solar field or the existing First Solar Agua Caliente Solar Field project may be visible from a few high points within Sears Point ACEC or the Anza Trail.

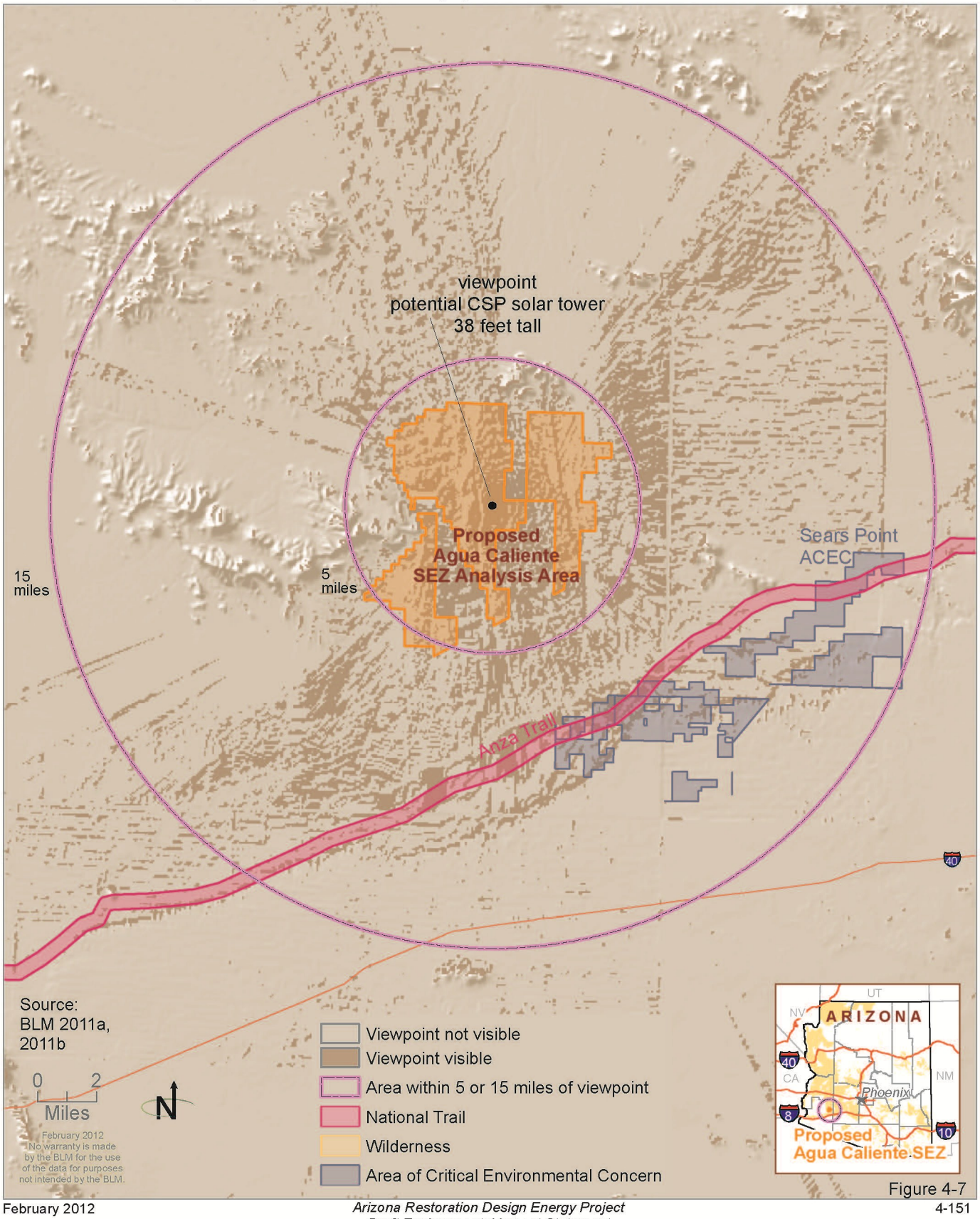


Figure 4-7

Visual Simulation of Sears Point and Juan Bautista de Anza National Historic Trail: Potential Concentrated Solar Power Technology 650 Feet Tall

View from Sears Point looking northwest towards the proposed Agua Caliente SEZ. Distance to SEZ: 9 miles.
Potential concentrated solar power technology would likely be visible according to this visual simulation.

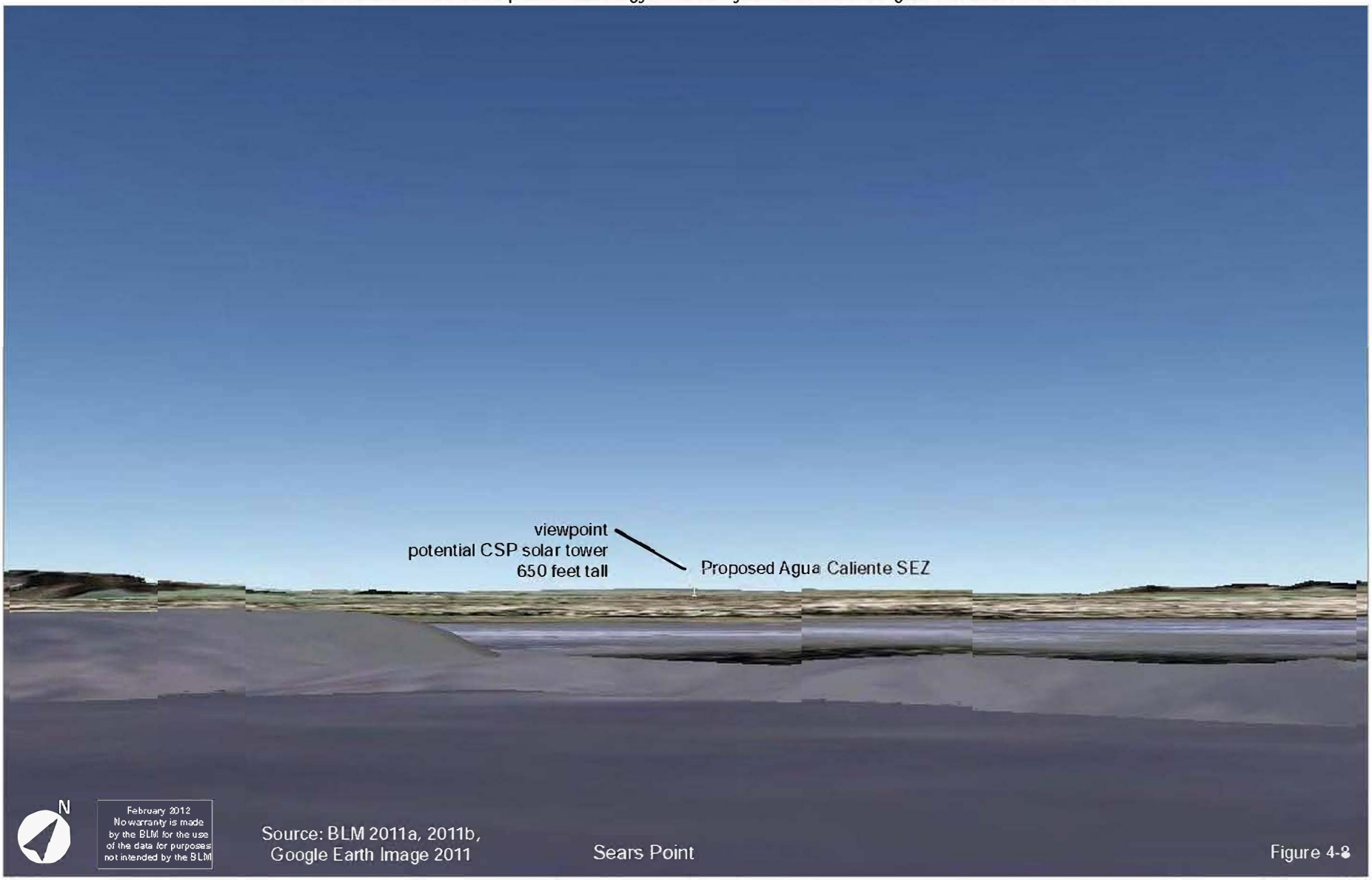


Figure 4-8

Visitors to areas outside of the 25-mile radius from the viewpoint are unlikely to see the potential CSP technology, though GIS calculations predict the viewpoint could possibly be visible from portions of the Woolsey Peak, Signal Mountain, and Eagletail Mountains Wilderness, were ideal conditions present. However, the visual simulations in **Figure 4-5**, Visual Simulation of Eagletail Mountain Wilderness: Potential Concentrated Solar Power Technology 650 Feet Tall, and **Figure 4-6**, Visual Simulation of Woolsey Peak and Signal Mountain Wilderness: Potential Concentrated Solar Power Technology 650 Feet Tall, demonstrate that even from the highest points in these wilderness areas, 650-foot-tall CSP technology would not be visible.

Figure 4-7, Viewshed Analysis of Proposed Agua Caliente SEZ Analysis Area: Potential Concentrated Solar Power Technology 38 Feet Tall, shows the visibility of a 38-foot CSP solar tower. Within 15 miles, the viewpoint might be visible from portions of the Juan Bautista de Anza National Historic Trail and portions of the Sears Point ACEC. Outside a 15-mile radius from the viewpoint, visibility is unlikely.

Visual simulations were also generated to illustrate the visibility of potential CSP technology 650 feet tall. The simulations generated an image from the highest point in the designated area looking towards the proposed Agua Caliente SEZ and potential 650-foot tower. As **Figure 4-8**, Visual Simulation of Sears Point and Juan Bautista de Anza National Historic Trail: Potential Concentrated Solar Power Technology 650 Feet Tall, shows, CSP technology 650-feet tall would likely be visible from the highest point in the Sears Point ACEC and Juan Bautista de Anza National Historic Trail. From a peak in the Eagletail Mountains Wilderness, potential CSP technology 650-feet tall would not be visible, as shown in **Figure 4-5**, nor would the 650-foot tower be visible from the Woolsey Peak and Signal Mountains Wilderness (**Figure 4-6**).

These analyses examined the impacts of a CSP solar tower system, which is most suitable for large utility-scale applications and is most likely to have the largest visual impact. However, the visual impacts of the solar development project would vary if other solar technologies were used. For example, PV systems, which are lower to the ground, would be less visible from afar than CSP technology. However, PV systems need to be scaled over a large area in order to be effective for utility-scale applications. If the PV field currently adjacent to the proposed Agua Caliente SEZ were expanded, the solar project would be less visible from a distance than CSP technology, but would likely need to extend over a larger footprint of land in order to harness the same amount of power. As such, the larger spread of a project on the proposed SEZ site could have a larger visual impact on the immediate surrounding areas.

An aerial viewshed analysis for a potential PV solar field six feet tall is provided in **Figure 4-9**, Viewshed Analysis of Proposed Agua Caliente SEZ Analysis Area: Potential Photovoltaic Solar Field 6 Feet Tall. This analysis suggests a potential

Viewshed Analysis of Proposed Agua Caliente SEZ: Potential Photovoltaic Solar Field 6 Feet Tall

This analysis assumes a potential photovoltaic solar field 6 feet tall. Infrastructure from a potential solar field or the existing First Solar Agua Caliente Solar Field project may be visible from a few high points within Sears Point ACEC or the Anza Trail.

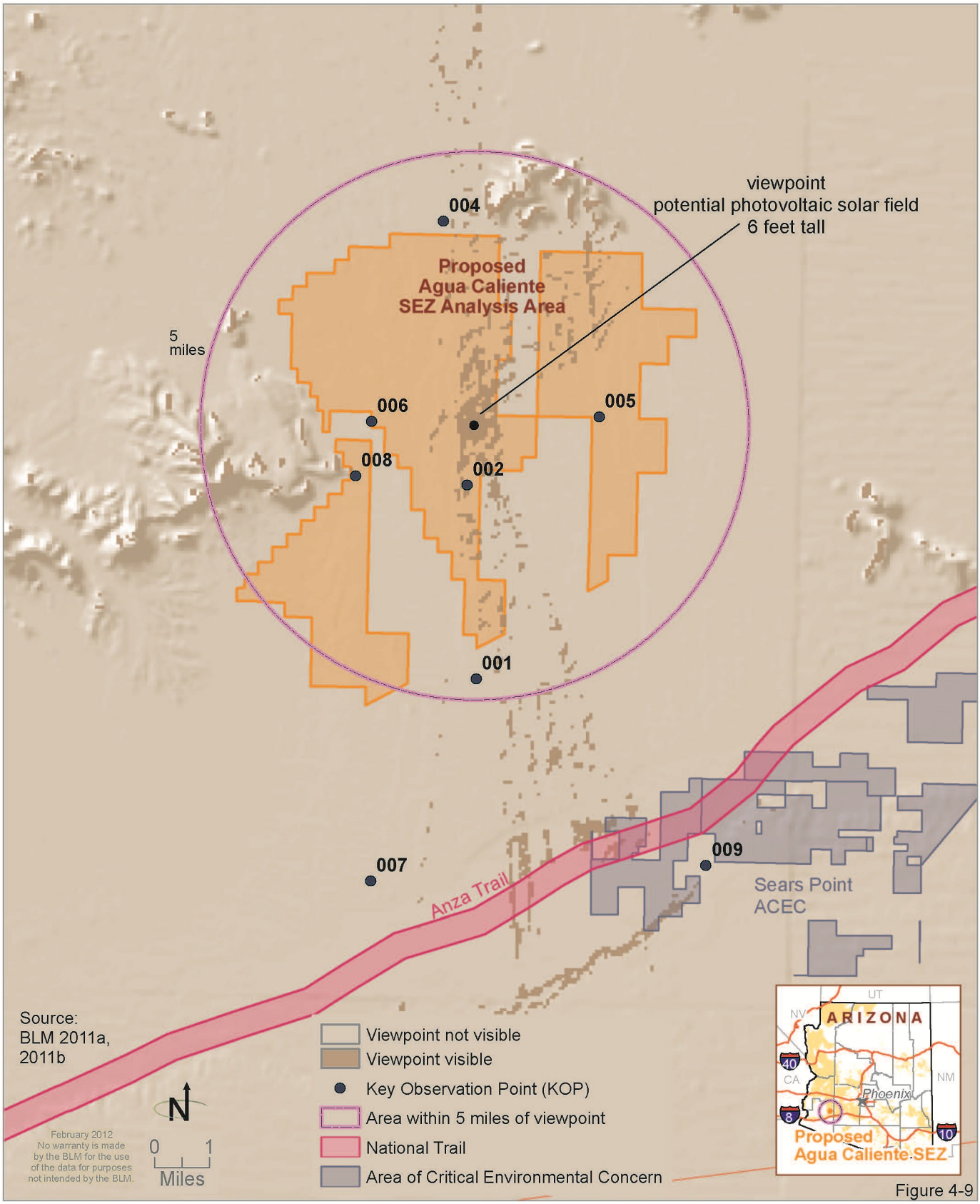


Figure 4-9

PV solar field, or the existing PV First Solar Agua Caliente Solar Field, may be visible from Sears Point ACEC or the Juan Bautista de Anza National Historic Trail. **Figure 4-10**, Visual Simulation of Sears Point and the Juan Bautista de Anza National Historic Trail: Potential Photovoltaic Solar Field 6 Feet Tall, provides a visual simulation of the view from Sears Point looking northwest towards the proposed Agua Caliente SEZ. According to this simulation, a potential PV solar field would likely be visible from nine miles away. From the same point nine miles from the proposed Agua Caliente SEZ, CSP technology would also likely be visible. A comparison of **Figures 4-8** and **4-10** provide an idea of how these visible impacts might vary. Additionally, **Figure 4-11**, Visual Simulations of Proposed Agua Caliente SEZ Analysis Area: Concentrated Solar Power Technology and Photovoltaic Solar Field, demonstrates the differing visual impacts of CSP and PV technology from both aerial and street views.

Other CSP technologies, such as linear concentrators and dish/engine systems, would also be lower to the ground than a CSP solar tower; the viewshed analysis for the 38-foot and 25-foot CSP solar tower would be analogous to these other CSP technologies. As their shorter height would be less intrusive, they would consequently be less visible from afar, although still visible.

All CSP technologies utilize mirrors to concentrate sunlight onto receivers. Concentrated PV systems also use lenses and mirrors to concentrate light onto solar cells. These technologies all have the potential to produce glare and light pollution that could impact the viewshed of surrounding areas. PV flat-plate systems do not use mirrors to concentrate sunlight and would be less likely to produce glare and light pollution that would impact surrounding viewsheds.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

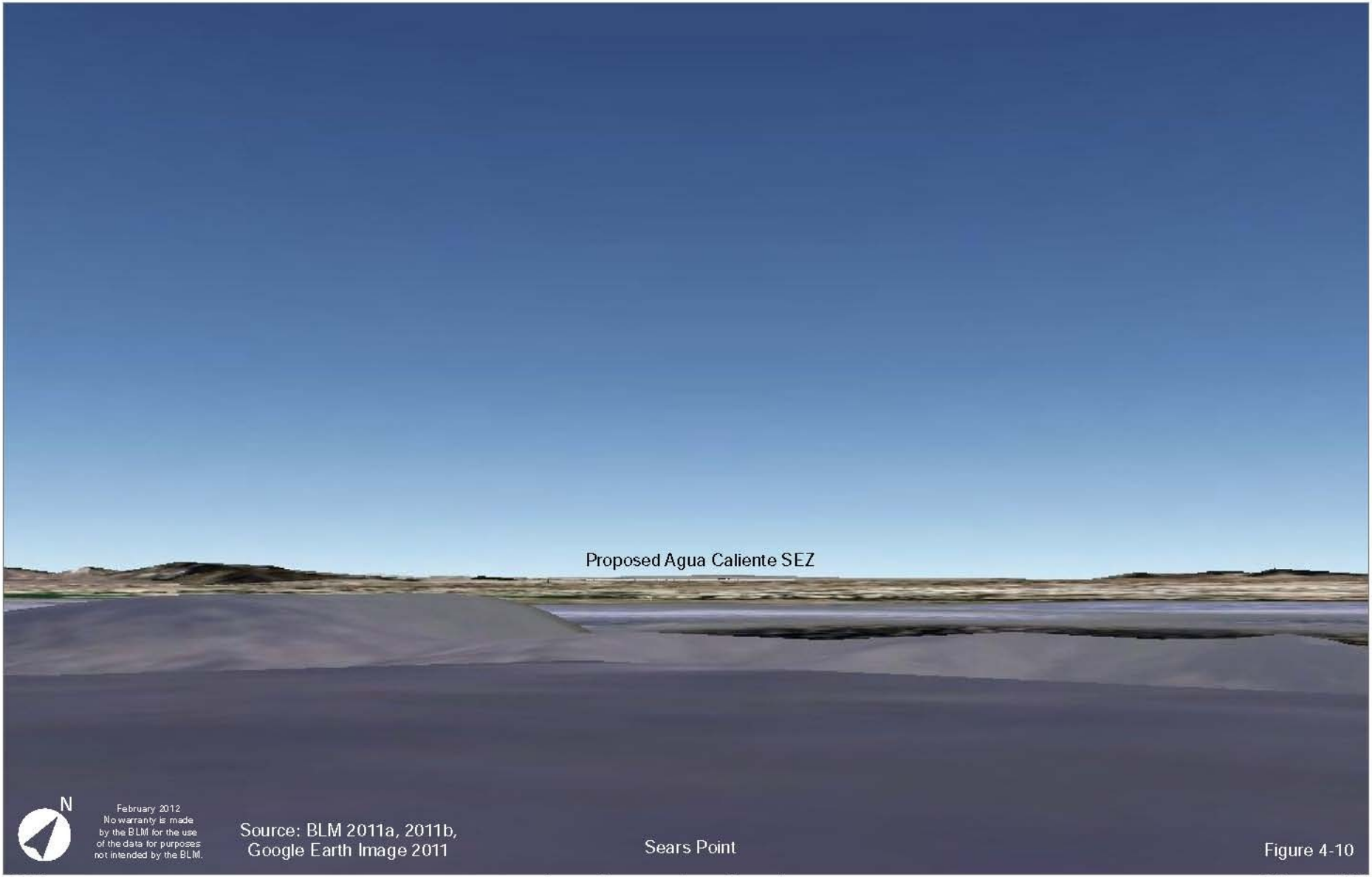
The nature and type of impact on visual resources would be the same as those described under Impacts Common to All Action Alternatives. Under Alternative 2, approximately 20,400 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA, which accounts for 9 percent of REDA lands under this alternative (BLM 2011a, 2011b).

Table 4-23, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 2, shows the total number of sensitive receptors and associated acreages within five miles of the REDA on BLM-administered land.

Four percent or less of each of the special designation areas listed in Table 4-23 would be within five miles of the proposed REDA on BLM-administered land. The viewsheds of these special areas have the potential to be impacted by solar and wind energy development, as described under Impacts Common to All Alternatives.

Visual Simulation of Sears Point and Juan Bautista de Anza National Historic Trail: Potential Photovoltaic Solar Field 5 Feet Tall

View from Sears Point looking northwest towards the proposed Agua Caliente SEZ. Distance to SEZ: 9 miles.
A potential PV solar field would likely be visible according to this visual simulation.



Visual Simulations of Proposed Agua Caliente SEZ: Concentrated Solar Power Technology and Photovoltaic Solar Field

Views from proposed Agua Caliente SEZ.







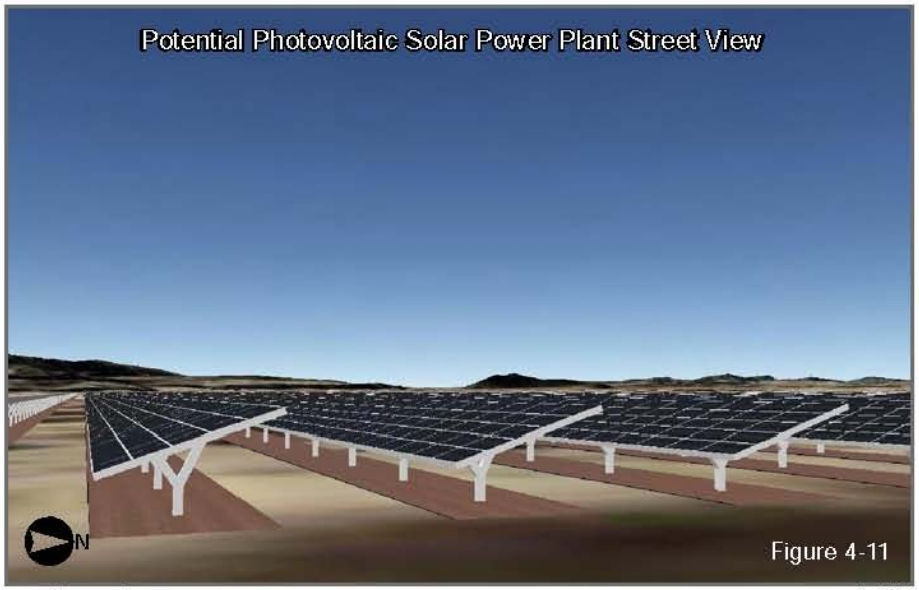


Table 4-23
Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 2

Sensitive Receptor	Number of Areas	Acres*
ACECs	18	32,900
BLM Wilderness	25	47,900
National Conservation Areas	2	100
Wilderness Study Areas	1	800
National Scenic and Historic Trails	3	17,500
National Monuments	4	30,700
NPS Land (includes National Parks, Wilderness, National Monuments, and NRAs)	2	10,000
Byways	2	40

Source: BLM 2011a, 2011b
*Acres may overlap one another if sensitive receptor is within five miles of another.
The sum of the acres in this table is greater than the total acres of sensitive receptors within five miles of REDA on BLM lands.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under Alternative 2, the Yuma Field Office RMP would be amended to designate the proposed Agua Caliente SEZ as VRM Class IV instead of VRM Class III. This would result in a 6,770-acre (1-percent) reduction in VRM Class III acres and a corresponding 6,770-acre (35-percent) increase in VRM Class IV (see **Table 4-22**, Proposed Changes to Yuma Field Office VRM Classes).

The VRI and viewshed analyses would be the same as those described for Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
The nature and type of impact on visual resources would be the same as those described under Impacts Common to All Action Alternatives. Under Alternative 3, approximately 13,500 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA, which accounts for 10 percent of REDA lands under this alternative (BLM 2011a, 2011b).

Table 4-24, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 3, shows the number of sensitive receptors and associated acreages within five miles of the proposed REDA on BLM-administered land.

Four percent or less of each of the special designation areas listed in Table 4-24 would be within five miles of the proposed REDA on BLM-administered land. The viewsheds of these special areas have the potential to be impacted by solar

Table 4-24
Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 3

Sensitive Receptor	Number of Areas	Acres*
ACECs	13	13,400
BLM Wilderness	19	27,100
National Conservation Areas	2	100
Wilderness Study Areas	1	800
National Scenic and Historic Trails	3	17,800
National Monuments	4	30,400
NPS Land (includes National Parks, Wilderness, National Monuments, and NRAs)	4	1,200
Byways	1	<40

Source: BLM 2011a, 2011b
*Acres may overlap one another if sensitive receptor is within five miles of another. The sum of the acres in this table is greater than the total acres of sensitive receptors within five miles of REDA on BLM lands.

and wind energy development, as described under Impacts Common to all Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under Alternative 3, the Yuma Field Office RMP would be amended to designate the proposed Agua Caliente SEZ as VRM Class IV instead of VRM Class III. This would result in a 2,760-acre (less than 1-percent) reduction in VRM Class III acres and a corresponding 2,760-acre (14-percent) increase in VRM Class IV (see **Table 4-22**, Proposed Changes to Yuma Field Office VRM Classes). The VRI and viewshed analyses would be the same as those described under Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Impacts would be similar to those described under Alternative 1. However, because more restrictions would be imposed to protect water resources under Alternative 4, development is more likely to be in the form of PV versus CSP, particularly in Zone 3 areas, due to the amount of water required for CSP technology. As discussed under Impacts Common to All Alternatives, PV development would generally be less visually obtrusive than CSP development, resulting in less visual impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be similar to those described under Alternative 1. However, because the proposed Agua Caliente SEZ is within the WPZ 2 area, more restrictions would be imposed to protect water resources under Alternative 4.

As such, development is more likely to be in the form of PV versus CSP technology due to the amount of water required for CSP technology. As discussed under Impacts Common to All Alternatives, PV development would generally be less visually obtrusive than CSP technology, resulting in less visual impacts.

Impacts from Alternative 5

Impacts from Land Tenure REDA

The nature and type of impact on visual resources would be the same as those described under Impacts Common to All Action Alternatives. Under Alternative 5, approximately 200 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA, which accounts for less than 1 percent of REDA lands under this alternative (BLM 2011a, 2011b).

Table 4-25, Number and Acres of Sensitive Receptors within Five Miles of BLM REDA and All REDA Lands, Alternative 5, shows the total number of sensitive receptors and associated acreages within five miles of a the proposed REDA on BLM-administered land.

Table 4-25
Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 5

Sensitive Receptor	Number of Areas	Acres
ACECs	8	2,800
BLM Wilderness	14	11,600
National Conservation Areas	2	100
Wilderness Study Areas	1	200
National Scenic and Historic Trails	3	4,700
National Monuments	4	6,400
NPS Land (includes National Parks, Wilderness, National Monuments, and NRAs)	4	400
Byways	2	40

Source: BLM 2011a, 2011b

*Acres may overlap one another if sensitive receptor is within five miles of another.

The sum of the acres in this table is greater than the total acres of sensitive receptors within five miles of REDA on BLM lands.

One percent or less of each of the special designation areas listed in Table 4-25 would be within five miles of the proposed REDA on BLM-administered land. The viewsheds of these special areas have the potential to be impacted by solar and wind energy development, as described under Impacts Common to all Alternatives.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

The nature and type of impact on visual resources would be the same as those described under Impacts Common to All Action Alternatives. Under Alternative 6, approximately 25,900 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA, which accounts for 11 percent of REDA lands under this alternative (BLM 2011a, 2011b).

Table 4-26, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 6, shows the number of sensitive receptors and associated acreages within five miles of the proposed REDA on BLM-administered land.

Table 4-26
Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 6

Sensitive Receptor	Number of Areas	Acres
ACECs	18	37,300
BLM Wilderness	25	52,000
National Conservation Areas	2	100
Wilderness Study Areas	1	800
National Scenic and Historic Trails	3	21,800
National Monuments	4	31,200
NPS Land (includes National Parks, Wilderness, National Monuments, and NRAs)	4	10,800
Byways	2	40

Source: BLM 2011a, 2011b

*Acres may overlap one another if sensitive receptor is within five miles of another. The sum of the acres in this table is greater than the total acres of sensitive receptors within five miles of REDA on BLM lands.

Five percent or less of each of the special designation areas listed in **Table 4-26** would be within five miles of the proposed REDA on BLM-administered land. The viewsheds of these special areas have the potential to be impacted by solar and wind energy development, as described under Impacts Common to all Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be the same as those discussed for Alternative 2.

4.2.23 Water Resources

Evaluation Methodology, Resource Indicators, and Assumptions

This section discusses potential impacts on water resources from the proposed allocation decisions, management actions, design features, and BMPs in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable

Development Scenario, and **Appendix B**, Design Features and Best Management Practices.

The methods to determine potential impacts on water resources included a review of relevant GIS data for the planning area. The GIS data were overlain with the actions found under each alternative, and conclusions were drawn based on an understanding that these types of actions may affect known surface and groundwater resources (**Section 3.23**, Water Resources). Impacts on water resources are evaluated only from the perspective of changes to water availability and quality. Impacts from the perspective of other values (e.g., impacts of water quality on livestock) are discussed in sections for the other resources. Effects are quantified where possible; in the absence of quantitative data, best professional judgment was used.

The following GIS data were used to conduct the analysis:

- National hydrography dataset;
- National Wetland Inventory;
- Groundwater basins;
- Active Management Areas;
- Irrigation Non-expansion Areas;
- BLM priority watersheds;
- EPA sole source aquifers; and
- Federal Emergency Management Act 100-year floodplains.

Potential impacts on water resources could occur if anticipated actions consistent with implementing the alternatives described in Chapter 2 were to:

- Alter surface water drainage patterns, which could result in increased sediment and turbidity in surface water drainages where renewable energy developments would be constructed;
- Release pollutants other than sediment into the environment during construction, operation, and maintenance of proposed facilities;
- Deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level;
- Result in flash flooding effects on proposed facilities;
- Create potential water pollution from leaks and spills of chemicals;
- Change ground cover that could decrease infiltration or increase surface runoff;

- Use facilities that would degrade surface or groundwater quality; or
- Concentrate and divert surface waters (such as dams, pipelines, or ditches, or those for other beneficial uses).

Water quality and quantity is also relevant to other resources. Biological resources, cultural resources, and recreation may be impacted by changes to water quantity and quality. While the development of renewable energy resources would be intricately linked with groundwater and surface water rights, those rights are specific to individual locations, aquifers, landowners, and local jurisdictions.

This analysis assumes the following:

- Land disturbance associated with construction activities varies between solar and wind energy technologies. Solar energy technologies would disturb 100 percent of the lands associated with solar projects. Wind energy projects typically disturb 10 percent of acres per GW of capacity; and
- Water use associated with siting/design, construction, operations, and decommissioning would vary between solar energy and wind energy technologies.

Impacts Common to All Alternatives

During the project siting and design phase of renewable energy development, water use would be negligible because activities would be limited to planning actions that would occur in an office environment.

During construction, water is needed primarily for fugitive dust control and for the workforce potable water supply. Water requirements for dust suppression would vary depending on the scale of the project. Water use related to dust suppression during construction activities would be estimated by applicants on a site-specific basis using the formulas and tables in the Draft Solar PEIS Sections 8.1.9 through 8.3.9 and Appendix M (pp. M-14 to M-16) (BLM and DOE 2010).

Solar project development would impact 100 percent of the lands associated with site grading, access road construction and ancillary facilities. Wind energy projects result in little ground disturbance outside of the actual turbine foundations, access roads, and ancillary facilities, which is estimated to be about 10 percent of the acres per GW of capacity.

The availability of groundwater and the impacts of groundwater withdrawal would need to be assessed during the siting/design phase of a renewable energy development project. Groundwater quality would need to be tested to verify that the quality would comply with drinking water standards; if water is not of

drinking water quality, then potable drinking water would be brought to the site.

The grading of renewable energy project sites could impact surface water quality and quantity. Potential impacts on water quality and quantity associated with sedimentation and erosion would be offset through the implementation of BMPs and design features in **Appendix B**.

For solar energy projects, water may be required for mirror/panel washing, workforce potable water supply, and cooling during operations. Water needs for cooling are a function of the energy technology and size of the energy development site. For wind energy projects, only a workforce potable water supply would be needed.

The availability of water rights and the impacts associated with groundwater withdrawals or surface water diversions would need to be assessed during the site characterization phase.

The operational phase of solar and wind energy projects involves inspections and maintenance activities. These activities include driving in vehicles, welding, painting, and lubricating, and could result in spills of petroleum, oils, and lubricants. Potential impacts on water quality associated with spills would be offset through the implementation of design features and BMPs in **Appendix B**.

During decommissioning and abandonment, all surface structures associated with the solar and wind projects would be dismantled and reclaimed to their pre-construction state. Activities and water needs during this phase would be similar to those during the construction phase with the addition of possible water needs for reestablishing vegetation in some areas. The total volume of water needed for decommissioning and reclamation is expected to be less than for the construction phase since this phase takes less time.

During the decommissioning and abandonment phase of solar and wind energy projects to support sustainable reuse of the developed lands, the BLM could opt to retain the construction conditions on the site in order to reuse the location for another purpose. Disturbed soils could impact downstream water quality. The implementation of a storm water pollution prevention plan would offset potential impacts on water resources and quality.

The decommissioning and reclamation phase of solar and wind energy projects involves the use of heavy construction equipment and personnel vehicles. These activities could result in spills of petroleum, oils, and lubricants. Potential impacts on water quality associated with spills would be offset through the implementation of design features and BMPs in **Appendix B**.

The specific impacts of solar and wind energy facilities development would depend on project location, technology and scale employed, development size,

and proximity to existing roads and transmission lines. On the basis of the assumptions given in the RFDS report (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona), land disturbance for solar facilities would be about 8 acres per MW, while land disturbance for wind facilities would be about 10 percent of the acres per GW capacity. However, due to the uncertainty of specific solar and wind development that would occur as a result of identifying lands within the REDA as available for solar and wind energy, it is not possible to quantify the total acreage affected on lands within the planning area, other than to identify the acreage of land that could be affected by maximum build-out. Implementation-level actions (development of specific solar and wind facilities) would be subject to further environmental review and would include quantifying the total acreage affected by site-specific development.

Impacts from the No Action Alternative

Under the No Action Alternative, renewable energy applications would continue to be processed on a case-by-case basis and would not include the required design features and BMPs noted in **Appendix B**. Without the REDA and the proposed SEZ being identified, applications are likely to occur on areas with sensitive water resources, and impacts similar to those noted above are likely to occur on surface and groundwater resources. Water would be used for each phase of development, as described in Impacts Common to All Alternatives; however, the volume of such water use is unknown because it is unknown whether the RFDS would be achieved in Arizona without the identification of areas of low resource sensitivity. As no comprehensive list of design features and BMPs would be distributed to BLM districts, there would be no consistent guidance for future renewable energy development.

Risks of contamination during all phases of development would be as described in Impacts Common to All Alternatives. Potential impacts on water quality associated with spills would be offset through the implementation of design features and BMPs identified in **Appendix B** on a case-by-case basis.

Impacts from Alternative 1

Impacts from Maximum REDA

While there would be no direct impacts from Alternative 1, indirect impacts associated with its implementation (i.e., project development) on water resources of the type noted in Impacts Common to All Alternatives could occur due to land disturbance and water use requirements associated with the possible future renewable energy development phases (construction, operations, decommissioning). These potential impacts would be reduced or avoided by applying the required design features and BMPs in **Appendix B**. Additionally, should future projects be proposed within the REDA, the site-specific analysis required for the project could suggest additional mitigation and protection measures that would be included in the ROW grant.

Specific to water resources, Alternative 1 was developed to guide renewable energy developers to areas where there are fewer resource conflicts (see **Section 2.2**, Alternative Development Process, and **Figure 2-1**, Proposed Agua Caliente SEZ), including eliminating surface waters, wetlands, streams, and floodplains from consideration as REDA. As a result, this alternative would have negligible impacts on surface water resources.

Alternative 1 has a suite of generalized design features and BMPs listed in **Appendix B** that would establish the minimum specifications for management of individual renewable energy projects and mitigate adverse impacts on water resources. However, these design features do not specify how much additional mitigation may be required. These design features would not restrict or indicate a preference for one type of technology over another. In general, implementing the management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, would mitigate impacts on water resources, but would not provide specific measures to protect designated areas including , INAs, BLM priority watersheds, or EPA sole source aquifers.

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers would be subject to review and approval by the ADWR. The sole source aquifer program allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees. **Table 4-27** identifies the Maximum REDA acreages of BLM-administered Lands by Designated Water Resource Area for Alternative 1.

Table 4-27
Alternative 1: Maximum REDA – BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	29,600	0	34,000	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Aqua Caliente SEZ is 20,600 acres. Aerial photographs and GIS data show approximately 300 acres of surface waters consisting of ephemeral washes in the SEZ. As noted in **Chapter 3**, Affected Environment, data on the Lower Gila Basin suggest there could be issues related to recharge and groundwater levels in the SEZ. Water resources in the proposed SEZ would be impacted by construction, operations, and reclamation activities as described in

Impacts Common to All Alternatives. Implementing the management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, would effectively avoid or reduce impacts on water resources within the proposed SEZ, but would not provide specific measures to protect water resources found in the proposed SEZ.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Indirect impacts associated with Alternative 2 would be the same as those described in Impacts Common to All Alternatives and Alternative 1 for surface and groundwater; however, there are 29,000 less acres of designated areas (BLM priority watersheds) under this alternative, as shown in **Table 4-28**, Alternative 2: Transmission REDA—BLM-administered Land Acres by Designated Water Resource Area. Alternative 2 has the same amount of AMAs, INAs, and sole source aquifers as Alternative 1.

Table 4-28
Alternative 2: Transmission REDA—BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	29,600	0	6,100	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers, would be subject to review and approval by the ADWR. The sole source aquifer program allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees.

Alternative 2 has the same suite of generalized design features and BMPs listed in **Appendix B** as Alternative 1, which would establish the minimum specifications for management of individual renewable energy projects and would mitigate adverse impacts on water resources. The nature and types of impacts from these measures would be the same as those described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Aqua Caliente SEZ is 6,770 acres. Aerial photographs and GIS data identify approximately 30 acres of surface waters consisting of ephemeral washes. As noted in **Chapter 3**, Affected Environment, data on the Lower Gila

Basin suggest there could be issues related to recharge and groundwater levels in the SEZ. Impacts would be similar to those described in Impacts Common to All Alternatives and Alternative 1. Implementing the management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, would effectively avoid or reduce impacts on water resources within the proposed SEZ, but would not provide specific measures to protect water resources found in the proposed SEZ.

Impacts from Alternative 3

Impacts from Load Offset REDA

Indirect impacts from Alternative 3 would be the same as those described in Impacts Common to All Alternatives and Alternative 1 for surface and groundwater; however, there are 30,200 acres less of BLM priority watersheds, and 900 acres less of AMAs under this alternative, as shown in **Table 4-29**, Alternative 3: Load Offset REDA—BLM-administered Land Acres by Designated Water Resource Area.

Table 4-29
Alternative 3: Load Offset REDA—BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	28,700	0	3,800	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

Alternative 3 has the same suite of generalized design features and BMPs listed in **Appendix B** as Alternative 1, which would establish the minimum specifications for management of individual renewable energy projects and would mitigate adverse impacts on water resources. The nature and types of impacts from these measures would be the same as those described under Alternative 1.

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers would be subject to review and approval by the ADWR. The sole source aquifer program allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Aqua Caliente SEZ is 2,760 acres. Aerial photographs and GIS data identify approximately 20 acres of surface waters consisting of ephemeral

washes. As noted in **Chapter 3**, Affected Environment, data on the Lower Gila Basin suggest there could be issues related to recharge and groundwater levels in the SEZ. Impacts would be similar to those described in Impacts Common to All Alternatives and Alternative 1. Implementing the management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, in the proposed SEZ would effectively avoid or reduce impacts on water resources, but would not provide specific measures to protect water resources found in the proposed SEZ.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Indirect impacts associated with implementation of decisions in Alternative 4 would be the same as those noted in Impacts Common to All Alternatives and Alternative 1 for surface and groundwater; however, there are 100 acres less designated areas (BLM priority watersheds) under this alternative, as shown in **Table 4-30**, Alternative 4: Water Conservation and Protection REDA—BLM-administered Land Acres by Designated Water Resource Area.

Table 4-30
Alternative 4: Water Conservation and Protection REDA—BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	29,600	0	33,900	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

Alternative 4 has the same suite of generalized design features and BMPs listed in **Appendix B** as Alternative 1, which would establish the minimum specifications for management of individual renewable energy projects and would mitigate adverse impacts on water resources. The nature and types of impacts from these measures would be the same as those described under Alternative 1. In addition, Alternative 4 includes additional water resource protection design features that identify additional protections in Water Resource Protection Zones 2 and 3, as shown in **Table 4-31**, Alternative 4: Water Conservation and Protection REDA—BLM-administered Land Acres in Each Water Protection Zone.

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers would be subject to review and approval by the ADWR. The sole source aquifer program

allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees.

Table 4-31
Alternative 4: Water Conservation and Protection REDA—BLM-administered Land Acres in Each Water Protection Zone

Water Protection Zone	Acres
1	0
2	30,200
3	33,300

Source: BLM 2011a, 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be similar to those described in Impacts Common to All Alternatives and Alternative 1. Implementing the management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, as well as the additional water resource design features for Water Protection Zone 2, in the proposed SEZ would effectively avoid or reduce impacts on water resources.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Indirect impacts associated with Alternative 5 would be the same as those described in Impacts Common to All Alternatives and Alternative 1 for surface and groundwater. However, there are 27,300 less acres of AMAs and 33,900 less acres of BLM priority watersheds under this alternative, as shown in **Table 4-32**, Alternative 5: Land Tenure REDA—BLM-administered Lands Acres by Designated Water Resource Area.

Table 4-32
Alternative 5: Land Tenure REDA—BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	2,300	0	100	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

Alternative 5 includes the same suite of generalized design features and BMPs listed in **Appendix B** as Alternative 1, which would establish the minimum specifications for management of individual renewable energy projects and

would mitigate adverse impacts on water resources. The nature and types of impacts from these measures would be the same as those described under Alternative 1.

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers, would be subject to review and approval by the ADWR. The sole source aquifer program allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Indirect impacts associated with Alternative 6 would be the same as those discussed in Impacts Common to All Alternatives and in Alternatives 1 and 4 for surface and groundwater. However, there are 27,800 less acres of designated areas (BLM priority watersheds) associated with Alternative 6, as shown in **Table 4-33**, Alternative 6: Collaborative-based REDA—BLM-administered Lands Acres by Designated Water Resource Area.

Table 4-33
Alternative 6: Collaborative-based REDA—BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	29,600	0	6,200	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

The proposed mitigation measures are the same as those described in Alternative 4. These identify additional protections in Water Resource Protection Zones 2 and 3, as shown in **Table 4-34**, Alternative 6: Collaborative-based REDA—BLM-administered Land Acres in Each Water Protection Zone.

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers, would be subject to review and approval by the ADWR. The sole source aquifer program allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts and proposed mitigation measures would be the same as those described in Alternative 4.

Table 4-34
Alternative 6: Collaborative-based REDA—
BLM-administered Land Acres in Each
Water Protection Zone

Water Protection Zone	Acres
1	0
2	2,400
3	33,400

Source: BLM 2011a, 2011b

4.2.24 Wild Horses and Burros

Evaluation Methodology, Resource Indicators, and Assumptions

This analysis addresses potential impacts on wild horses and burros from implementing the management actions under the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning wild horses and burros are described in **Section 3.24**, Wild Horses and Burros. This analysis focuses on solar and wind energy development that has the potential for disturbance of wild horses and burros or alterations to HMAs, either by reducing the area available for HMAs or changing the availability of forage, water, or other critical habitat components in HMAs. It should be noted that HMAs are composed of public and private lands, and negotiations with private landowners allow for federally supervised protection of wild horses on private lands. In order to analyze the potential for impacts of development on lands adjacent to HMAs, acres of HMAs on private and BLM-administered lands within a 5-mile buffer of the REDA were identified.

Site-specific impacts would be influenced by location, magnitude, technology, type of development, and soil and vegetation conditions of developed sites.

The following indicators/significance criteria were used to determine impacts in the analysis:

- Levels of changes in available forage and water; and
- Levels of changes in permitted appropriate management level (the maximum number of animals sustainable on a yearlong basis).

The following assumptions were made:

- The wild horse and burro population would continue to increase in the absence of active management.

- Wild horse and burro herds would be managed within the appropriate management level range through gathers and the selected application of additional population control practices.
- Management actions on HAs would not impact wild horses and burros, as BLM does not manage HAs for wild horses and burros.

Impacts Common to All Alternatives

Wild horses and burros would be impacted by renewable energy development. The degree of impact would depend on the location of the development relative to wild horse and burro populations. Potential impacts include but are not limited to the following:

- Direct displacement from area of development.
- Reduction of available forage due to loss of acres available for use in HMAs. This reduction in forage may necessitate a reduction in appropriate management levels in HMAs to match forage availability on the remaining portion(s) of HMAs.
- Disturbance due to construction noise and, to a lesser extent, operations noise from some technologies, including wind farms.
- Habitat fragmentation and blockage of movement, primarily associated with fencing of utility-scale solar farms. Once constructed, wind farms and transmission line facilities would not prevent use of the land by horses or burros other than in the areas physically occupied by the facilities such as the support towers and substations. However, wild horses and burros could be subject to disturbance or harassment.
- Potential for vehicular collisions due to additional roads and increased traffic near facilities.
- Disturbance from human activity during construction and plant operations and maintenance. This impact would generally be greatest for utility-scale solar development due to the larger acreage impacted, and may be lesser in scale for community-scale solar or wind, for which some use of wind farms by horse and burros may be compatible during operation. Human disturbance would have secondary impacts, including the increased potential for wildfire and spread of noxious weeds.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind development by statute, regulation, or proclamation would remain excluded, and administratively excluded areas would be assessed based on management in local land use plans. Impacts on wild horses and burros would be assessed on a project-specific level. In the absence of identifying the

REDA, solar and wind project development would likely result in patchy, fragmented development with an increased likelihood of fragmentation of wild horse or burro ranges. In addition, no standard set of design features or BMPs would be developed for protection of wild horses and burros.

Impacts from Alternative 1

Impacts from Maximum REDA

All HMAs have been eliminated from the REDA; therefore, impacts on wild horse and burros would be negligible. There is limited potential for impacts to occur should development occur in a REDA adjacent to a HMA. Under Alternative 1, approximately 64,400 acres of HMAs on BLM-administered lands are within five miles of the REDA. In particular, actions that reduced available water in the surrounding area may impact wild horse and burro herds. Water is a limited resource throughout much of the planning area and may partially dictate the capacity of a habitat to support wild horses and burros.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed SEZ would have negligible impacts on wild horses and burros as it is not within or adjacent to any HMAs.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and types of impacts would be the same as those described for Alternative 1. However, under this alternative, approximately 43,400 acres of HMAs on BLM-administered lands are within 5 miles of the REDA; therefore, the scale of impacts would be reduced.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be the same as described for Alternative 1.

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and types of impacts would be the same as those described for Alternative 1. Under this alternative, approximately 2,600 acres of HMAs on BLM-administered lands are within 5 miles of the REDA; therefore, the scale of impacts would be reduced.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be the same as described for Alternative 1.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The nature and type and of impacts would be similar to those described for Alternative 1. Design features that limit the withdrawal of groundwater under this alternative, however, may reduce the potential for impacts on water availability for wild horses and burros in HMAs adjacent to the REDA. Total acres of HMAs within five miles of the REDA are the same as Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
The nature and type and of impacts would be the same as those described for Alternative 1. Under this alternative, approximately 8,300 acres of HMAs on BLM-administered lands are within 5 miles of the REDA; therefore, the scale of impacts would be reduced.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
The nature and type of impacts would be similar in nature to those described in Alternative 1. As in Alternative 4, however, design features that limit the withdrawal of groundwater under may reduce the potential for impacts on water availability for wild horses and burros in HMAs adjacent to the REDA. Total acres of HMAs within five miles of the REDA are the same as in Alternative 2.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

4.2.25 Wilderness Characteristics

Evaluation Methodology, Resource Indicators, and Assumptions
Impacts on lands with wilderness characteristics were assessed by considering the potential for degradation of wilderness characteristics to a level at which the characteristic would no longer be present within the specific area. The primary concern regarding impacts on wilderness characteristics is the loss of opportunities for solitude, naturalness, and primitive and unconfined recreation, to the point where the area no longer has wilderness characteristics. There would be no direct impacts from the identification of a REDA. Indirect impacts on wilderness characteristics would result from implementing the planning decisions and possible future ground-disturbing activities associated with construction of renewable energy facilities, as well as from proximity to such activities.

While permitting solar and wind energy development on lands with wilderness characteristics managed for other uses would be in compliance with RMP decisions, such development would impact wilderness characteristics and, as such, are included in this discussion.

Impacts Common to All Alternatives
Lands with wilderness characteristics may be impacted by solar and wind energy development on BLM-administered lands adjacent to or within the viewshed of the areas. These impacts could include effects on opportunities for solitude, naturalness, and scenic values.

The most significant impacts on lands with wilderness characteristics are likely to occur during the construction, operation and maintenance, and reclamation/abandonment stages of the project. The siting/design phase is likely to have a negligible impact.

The construction or upgrading of roads may be necessary to transport workers to the site. This would result in an increase in traffic and associated dust from vehicles, which could impact wilderness characteristics if located in the viewshed of areas with wilderness characteristics. Trenching to bury cables and equipment used in construction may create noise that would limit an experience of solitude and may be visible from areas with wilderness characteristics. During operation and maintenance, plumes of steam or dust may be visible as well. Additionally, the presence of workers during the construction, operation, and reclamation phases of the project would likely contribute to increased vehicle presence around the site, impacting the solitude and naturalness of the area.

These impacts could limit the wilderness characteristics of a parcel of land through proximity and increased evidence of human activity. Other possible effects on wilderness characteristics would be light pollution and impacts on the viewing experience, if any portion of the site and its associated effects is within the viewshed of an area with wilderness characteristics. Light pollution and the portion of site in the viewshed could vary based on the type of solar technology used. For example, a CSP system might be more visible (i.e., power tower systems) from an area with wilderness characteristics and might produce more glare than a PV system.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind energy development would continue to be authorized through the lands and realty program via a ROW grant. Because solar and wind energy development would diminish wilderness characteristics, it is assumed that such actions would not be permitted on lands managed to maintain these characteristics. As such, wilderness characteristics of these lands would be provided some direct protection from impacts associated with solar and wind energy development.

On lands with wilderness characteristics but not managed to maintain these characteristics, solar or wind development could occur unless the proposed project site has been identified as a ROW exclusion area (based upon the presence of some other sensitive resources). ROW exclusion areas would protect lands with wilderness characteristics by prohibiting all new ROW authorizations, including solar and wind energy development. Outside of ROW exclusion areas, if solar or wind energy development were to occur on lands with wilderness characteristics not managed to maintain these characteristics, the nature and type of impact would be the same as described under Impacts Common to All Alternatives.

For all lands with wilderness characteristics, potential impacts from solar and wind development adjacent to or within the viewshed of the lands with wilderness characteristics would be the same as those described under Impacts Common to All Alternatives. The magnitude of impact would vary by field office and would depend upon RMP decisions, including ROW allocations (e.g., exclusion and avoidance), VRM class, and existing land uses.

Impacts from Alternative 1

Impacts from Maximum REDA

All lands with wilderness characteristics have been identified as 'Areas with Known Sensitive Resources' (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]). As such, these lands have been eliminated from consideration as a REDA. Therefore, negligible direct impacts on wilderness characteristics are anticipated. However, wilderness characteristics may experience indirect impacts from solar and wind energy development on BLM-administered lands adjacent to or within the viewshed of the eliminated areas similar to those described in Impacts Common to All Alternatives.

The analysis also considered lands with wilderness characteristics within five miles of the REDA. Under Alternative 1, 2,300 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted by solar and wind energy development as described under Impacts Common to All Alternatives. Similarly, 79,700 acres of lands with wilderness characteristics but not managed to maintain these characteristics under the applicable RMP are within five miles of the REDA and could also be indirectly impacted as described under Impacts Common to All Alternatives.

Implementing the management actions, design features, and BMPs noted in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, are anticipated to reduce impacts on lands with wilderness characteristics.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 1, the lands with wilderness characteristics currently managed to maintain these characteristics would continue to be managed to maintain these characteristics (BLM 2010g).

A total of 9,660 acres of land with wilderness characteristics were identified within the proposed Agua Caliente SEZ, none of which are being managed to maintain these characteristics. As discussed under Impacts Common to All Alternatives, impacts from solar development on these lands would diminish the naturalness of the area as well as opportunities for solitude and primitive or unconfined recreation to the degree that these characteristics may cease to exist in the area, resulting in a reduction in total acres of lands with wilderness characteristics. However, the 210 acres that best contained the required

opportunities for solitude, naturalness, and primitive and unconfined recreation would continue to be managed to maintain wilderness characteristics.

Implementing the management actions, design features, and BMPs noted in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, are anticipated to reduce impacts on lands with wilderness characteristics.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, 2,300 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives. Similarly, 49,400 acres of lands with wilderness characteristics but not managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 2, 1,700 acres of land with wilderness characteristics but not managed to maintain wilderness characteristics would be within the proposed Agua Caliente SEZ. As discussed under Impacts Common to All Alternatives, impacts from solar development on these lands would diminish the naturalness of the area as well as opportunities for solitude and primitive or unconfined recreation to the degree that these characteristics may cease to exist in the area, resulting in a reduction in total acres of lands with wilderness characteristics.

Impacts from Alternative 3

Impacts from Load Offset REDA

Under Alternative 3, 2,300 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives. Similarly, 44,600 acres of lands with wilderness characteristics but not managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 3, 370 acres of land with wilderness characteristics but not managed to maintain wilderness characteristics would be within the proposed SEZ. As discussed under Impacts Common to All Alternatives, impacts from solar development on these lands would diminish the naturalness of the area as well as opportunities for solitude and primitive or unconfined recreation to the degree that these characteristics may cease to exist in the area, resulting in a reduction in total acres of lands with wilderness characteristics.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Impacts would be the same as those described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Agua Caliente SEZ analysis area is the same as described in Alternative 1. As such, impacts would be the same as those described under Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Under Alternative 5, 1,100 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives. Similarly, 3,400 acres of lands with wilderness characteristics but not managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Under Alternative 6, 2,300 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives. Similarly, 61,500 acres of lands with wilderness characteristics but not managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Agua Caliente SEZ analysis area is the same as described in Alternative 2. As such, impacts would be the same as those described under Alternative 2.

4.3 Additional Mitigation Measures, Unavoidable Adverse Impacts, Irreversible and Irretrievable Commitment of Resources, and Relationship of Short-term Uses of the Environment to Long-term Productivity

This section includes a summary table of the additional mitigation measures noted in individual sections of the impact analysis and describes the unavoidable adverse environmental impacts, irreversible and irretrievable commitments of resources, and the relationship between short-term uses of the environment and long-term productivity as required in 40 CFR 1502.16.

4.3.1 Additional Mitigation Measures

Table 4-35, Additional Mitigation Measures, includes a summary of the additional mitigation measures noted in individual sections of the impact analysis.

Table 4-35
Additional Mitigation Measures

Resource	Additional Mitigation Measures
Land Use and Realty	Consolidation of access and other supporting infrastructure should be required for single projects and for cases in which there is more than one project in close proximity to another to maximize the efficient use of public land. Coordination with federal, state, and county agencies; tribes; property owners; and other stakeholders should be accomplished as early as possible in the planning process to identify potentially significant land use conflicts and issues and state and local rules that govern solar energy development. Significant issues that are raised, and potential modifications to proposed projects to eliminate or mitigate these issues, should be considered in the environmental analysis of a project application. Where there are existing BLM ROW authorizations within development areas, pursuant to Title 43, Part 2807.14 of the CFR (43 CFR 2807.14), the BLM would notify ROW holders that an application that might affect their existing ROW has been filed and would request their comments. Early discussion with existing ROW holders should occur to ensure their rights are protected and any issues are resolved.
Paleontology	If avoidance is chosen as the preferred mitigation measure, projects should be located, designed, or modified to avoid impacts on significant resources. Use of management practices such as training/education programs to reduce the amount of inadvertent destruction to paleontological sites could reduce the occurrences of human-related disturbances to nearby sites. The specifics of these management practices would be established in project-specific coordination between the project developer and the managing agency.

4.3.2 Unavoidable Adverse Impacts

Unavoidable adverse environmental impacts are impacts that would occur after implementation of all feasible mitigation measures. The environmental impacts of the proposed project are described in this chapter, while cumulative impacts are described in **Chapter 5**, Cumulative Impacts. The analysis has identified impacts that are unavoidable adverse environmental impacts, as summarized below in **Table 4-36**, Unavoidable Adverse Impacts. These impacts, while adverse, are not considered substantial after implementing environmental protection measures described in **Appendix B**, Design Features and Best Management Practices, and in **Table 4-35**, Additional Mitigation Measures.

Table 4-36
Unavoidable Adverse Impacts

Resource	Unavoidable Adverse Impacts
Air Quality	Unavoidable air quality impacts due to dust generated during site preparation and construction.
Energy and Minerals	Solar and wind energy facilities would be incompatible with most types of mineral production because of the intensive land coverage required. Issuance of ROWs establishes a superior right as to other subsequent actions, (i.e., location of mining claims). In areas of high mineral potential, the establishment of solar and wind energy facilities would constrain the exploration for and development of locatable minerals on lands encumbered by these facilities. There would be a short-term reduction in available salable minerals within the REDA and/or SEZ; however, additional saleable minerals would be available elsewhere outside the REDA and/or SEZ, mitigating this impact.
Fish and Wildlife	Construction activities, heavy equipment, and vehicle use on site during construction could potentially cause mortality or injury to a variety of wildlife species, especially slower-moving species, small animals, species that have subsurface burrows, or ground- or shrub-nesting birds. Noise from construction could also cause short-term disturbance to wildlife, which may disrupt behavior.
Livestock Grazing	Land developed for renewable energy use, including that occupied by solar panels, wind tower pads, and associated infrastructure, would not be available for livestock grazing.
Noise	There could be unavoidable noise impacts from the use of heavy construction equipment, depending on the scale and location of individual projects.
Recreation	Solar and wind energy development within the REDAs and adjacent important recreation areas could impact experiences by altering physical setting characteristics. Development would most likely impact those users seeking middle- or backcountry experiences in a less-developed setting. The extent of potential impacts would depend on the project's location and extent, timing, technology, and topography between the proposed site and the potentially affected recreation area.
Socioeconomics	Potential for short-term (during construction) and long-term impacts on current land uses and associated impacts on social and economic resources.
Soils	Construction of solar or wind energy development projects would cause the disturbance of soils where facilities are placed. In addition, it would take at least several years to successfully reestablish soil conditions in temporarily impacted areas. Grading, construction, maintenance, and other surface-disturbing activities on sensitive, protective soil surface layers such as biotic crusts and desert pavement, which take very long periods to form, are effectively irretrievable. Increases in erosion due to disturbance of these surfaces will persist for lengthy, unknown periods. Implementation of design criteria and BMPs will reduce erosion in these and other areas, assuming that channel head-cutting or other severe erosion does not become established. The total acres of soil disturbance cannot be determined at this time due to uncertainty in project locations.

Table 4-36 *(continued)*
Unavoidable Adverse Impacts

Resource	Unavoidable Adverse Impacts
Special Status Species	There is limited potential for death or injury to special status species during project construction, operation, and reclamation. Construction of solar or wind energy development projects would cause the permanent removal of native vegetation where facilities are placed, thus eliminating this area as potentially suitable habitat for the life of the project. Project areas disturbed during construction would be unavailable for at least several years as vegetation was reestablished. The total acres of habitat loss cannot be determined at this time.
Vegetation	Construction of solar or wind energy development projects would cause the permanent removal of native vegetation where facilities are placed. In addition, it would take at least several years to successfully reestablish vegetation in temporarily impacted areas. The total acres of vegetation removal cannot be determined at this time.
Visual Resources	Solar and wind development under the action alternatives and under the No Action Alternative would result in unavoidable, long-term adverse impacts, impacts on residents of communities near solar facilities, users of roads passing near solar facilities, and patrons of specially designated areas within the viewshed of solar facilities. The magnitude of these adverse impacts would to some degree depend on a specific project and would be decreased by implementing the programmatic design features required under the action alternatives (e.g., siting facilities away from the most sensitive resources), although the extent to which these impacts could be mitigated cannot be assessed, except at the project level, and it is possible these impacts could not be completely avoided.
Wilderness Characteristics	Sights, sounds, and evidence of nearby human activity resulting from solar and wind energy development are unavoidable and would adversely affect the experience of solitude and naturalness in areas with wilderness characteristics. Some of these impacts can be mitigated through measures such as designing equipment and structures in a manner that mimics the geography of the area, directing vehicles traveling to the solar energy site to follow a path avoiding as much land with wilderness characteristics as possible, and implementing measures to limit light pollution. However, to a large degree many of the signs of human presence, like smoke and dust from the operation of the solar energy plant, are unavoidable impacts.

4.3.3 Irreversible and Irretrievable Commitment of Resources

A resource commitment is considered irreversible when direct and indirect impacts from its use limit future use options. Irreversible commitments apply primarily to nonrenewable resources, such as cultural resources, and also to those resources that are renewable only over long periods of time, such as soil productivity. A resource commitment is considered irretrievable when the use or consumption of the resource is neither renewable nor recoverable for future use. Irretrievable commitment applies to the loss of production, harvest, or natural resources. **Table 4-37**, Irreversible and Irretrievable Commitment of

Resources summarizes the findings. The management actions, design features, BMPs, and additional mitigation measures described above would be implemented to ensure that all natural resources are conserved to the maximum extent practicable.

Table 4-37
Irreversible and Irretrievable Commitment of Resources

Resource	Irreversible and Irretrievable Commitment of Resources
Cultural Resources	Cultural resources are nonrenewable and, once damaged or destroyed, are not recoverable. Therefore, if a cultural resource is damaged or destroyed during solar or wind energy development, this particular cultural location, resource, or object would be irretrievable.
Energy and Minerals	Solar and wind energy development would result in the consumption of salable minerals such as sand and gravel.
Livestock Grazing	Land would be disturbed during construction and during the life of a project and would be unavailable for livestock grazing. Land not needed for operation and maintenance of the facilities would be reclaimed immediately after construction. At the end of the useful life of a proposed project, developed lands could be reclaimed for livestock grazing use as well.
Paleontological Resources	Paleontological resources are nonrenewable and, once damaged or destroyed, cannot be recovered. Therefore, if a paleontological resource (specimen, assemblage, or site) is damaged or destroyed during renewable energy development, this scientific resource would become irretrievable.
Soils	Grading, construction, maintenance, and other surface-disturbing activities on sensitive, protective soil surface layers such as biotic crusts and desert pavement, which take very long periods to form, are effectively irretrievable. Increases in erosion due to disturbance of these surfaces will persist for lengthy, unknown periods. Implementation of design criteria and BMPs will reduce erosion in these and other areas, assuming that channel head-cutting or other severe erosion does not become established.
Special Status Species	Most solar energy development projects would cause the irreversible loss of habitat that would otherwise have been available for wildlife to use. While every effort would be made to recover native vegetation and habitat, full restoration of preexisting conditions is not assured.
Vegetation	Most solar energy development projects would cause the irreversible loss of vegetation that would otherwise have been available for wildlife to use. While every effort would be made to recover native vegetation and habitat, full restoration of preexisting conditions is not assured.
Visual Resources	The introduction of any new manmade line, form, color, or texture into an existing landscape will cause a change, however slight or great, in the existing visual resource inventory conditions (even if the VRM objectives are met), and for the most part, is generally irreversible because few manmade footprints upon the landscape that result from the spread of a growing civilization are ultimately removed completely.

Table 4-37 *(continued)*
Irreversible and Irretrievable Commitment of Resources

Resource	Irreversible and Irretrievable Commitment of Resources
Wilderness Characteristics	The solitude, naturalness, and opportunities for primitive and unconfined recreation of the areas with wilderness characteristics can be retrieved if the project were abandoned and the surrounding area restored. It is possible that through reclamation, areas could return to a state of apparent naturalness, a state appearing natural to the average visitor who is not familiar with the biological composition of natural verses human-affected ecosystems, but would be unable to return to a state of natural integrity, that is, the state of an ecosystem being relatively unaffected by human activities.

4.3.4 Relationship of Short-term Uses of the Environment to Long-term Productivity

This section compares the potential temporary effects of the actions analyzed in this EIS on the environment with the potential effects on its long-term productivity. The BLM must consider the degree to which the proposed action or alternatives would sacrifice a resource value that might benefit the environment in the long term, for some temporary value to a project proponent or the public. **Table 4-38**, Relationship of Short-term Uses of the Environment to Long-term Productivity summarizes the findings.

Environmental protection measures described in the management actions, design features, BMPs, and additional mitigation measures would be employed to reduce disturbances and reclaim or improve vegetation cover, soil, and wildlife habitat on these lands. While the degree of reclamation is unknown, to the extent that disturbances can be reclaimed, other productive use of these lands would not be precluded in the long term.

Table 4-38
Relationship of Short-term Uses of the Environment to Long-term Productivity

Resource	Relationship of Short-term Uses of the Environment to Long-term Productivity
Air Quality	Short-term construction activities would impact air quality, while the long-term productivity of the renewable energy facilities would result in reductions of combustion-related emissions, assuming these facilities offset electricity generated by fossil fuel power plants.
Greenhouse Gases	Short-term construction activities would emit GHGs, while the long-term productivity of the renewable energy facilities would result in reductions of GHG emissions, assuming these facilities offset electricity generated by fossil fuel power plants.
Fish and Wildlife	There may be some loss of existing vegetation, soil, and habitat available for wildlife, but the REDA has been selected to avoid most high quality wildlife habitat, so wind and solar energy development within the REDA would not result in the loss of rare resources. Full recovery of these lands and restoration of any lost habitat or associated wildlife is not assured.

Table 4-38 *(continued)*
Relationship of Short-term Uses of the Environment to Long-term Productivity

Resource	Relationship of Short-term Uses of the Environment to Long-term Productivity
Livestock Grazing	Where undeveloped land is used for facilities, some grazing uses could continue within a project site. A project's use of the environment has very little adverse impact on the maintenance and enhancement of long-term productivity as the development of renewable energy facilities is unlikely to physically preclude livestock grazing if the facility is decommissioned in the future.
Soils	Most renewable energy development projects would cause removal of vegetation and disturbance of soil resources. While every effort would be made to restore soil conditions, full restoration of preexisting conditions is not assured and would take many years. In particular, grading, construction, maintenance, and other surface-disturbing activities on sensitive, protective soil surface layers such as biotic crusts and desert pavement, which take very long periods to form, are effectively irretrievable. Increases in erosion due to disturbance of these surfaces will persist for lengthy, unknown periods. Implementing design criteria and BMPs would reduce erosion in these and other areas, assuming that channel head-cutting or other severe erosion does not become established.
Special Status Species	There would be some loss of habitat under the proposed action, but the REDA has been designed to avoid habitat important to special status species; therefore, the project should not significantly contribute to the population decline in special status species, lead to federal listing of species, or lead to species extinction.
Vegetation	There would be some loss of existing vegetation, but most of the planning area has vegetation cover that is common to the region, so a project would not result in the loss of rare resources.
Wilderness Characteristics	Identifying the proposed Agua Caliente SEZ and developing utility-scale solar energy on lands with wilderness characteristics would result in a loss of those wilderness characteristics.

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CHAPTER 5
CUMULATIVE IMPACTS

5.1 INTRODUCTION

This chapter presents the likely cumulative impacts on the human and natural environment that could occur from implementing the alternatives presented in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. This chapter is organized by topic, similar to **Chapter 3**, Affected Environment, and **Chapter 4**, Environmental Consequences.

Cumulative impacts are effects on the environment that result from the impact of implementing any one of the RDEP alternatives in combination with other actions outside the scope of this plan, either within the planning area or adjacent to it. Cumulative impact analysis is required by CEQ regulations because environmental conditions result from many different factors that act together. The total effect of any single action cannot be determined by considering it in isolation, but must be determined by considering the likely result of that action in conjunction with many others. Evaluation of potential impacts considers incremental impacts that could occur from the proposed project, as well as impacts from past, present, and reasonably foreseeable future actions. Management actions could be influenced by activities and conditions on adjacent public and non-public lands beyond the planning area boundary; therefore, assessment data and information could span multiple scales, land ownerships, and jurisdictions. These assessments involve determinations that often are complex and, to some degree, subjective.

5.1.1 Cumulative Analysis Methodology

The cumulative impacts discussion that follows considers the alternatives in the context of the broader human environment – specifically, actions that occur outside the scope and geographic area covered by the planning area. Cumulative impact analysis is limited to important issues of national, regional, or local significance; therefore, not all resources identified for the direct and indirect impact analysis in this EIS are analyzed for cumulative impacts. Resources not

discussed in detail include geology and seismicity, national trails, and public health and safety.

Because of the programmatic nature of the RDEP EIS and cumulative assessment, the analysis tends to be broad and generalized to address potential effects that could occur from a reasonably foreseeable management scenario combined with other reasonably foreseeable activities or projects. Consequently, this assessment is primarily qualitative for most resources because of lack of detailed information that would result from project-level decisions and other activities or projects. Quantitative information is used whenever available and as appropriate to portray the magnitude of an impact. The analysis assesses the magnitude of cumulative impacts by comparing the environment in its baseline condition with the expected impacts of the alternatives and other actions in the same geographic area. The magnitude of an impact is determined through a comparison of anticipated conditions against the naturally occurring baseline as depicted in the affected environment (see **Chapter 3**, Affected Environment) or the long-term sustainability of a resource or social system.

The following factors were considered in this cumulative impact assessment:

- Federal, nonfederal, and private actions.
- Potential for synergistic effects or synergistic interaction among or between effects.
- Potential for effects across political and administrative boundaries.
- Other spatial and temporal characteristics of each affected resource.
- Comparative scale of cumulative impacts across alternatives.

Temporal and spatial boundaries used in the cumulative analysis are developed on the basis of resources of concern and actions that might contribute to an impact. The baseline date for the cumulative impacts analysis is 2010. The temporal scope of this analysis is a 20-year planning horizon.

Spatial boundaries vary and are larger for resources that are mobile or migrate (e.g., deer populations) compared with stationary resources. Occasionally, spatial boundaries could be contained within the planning area boundaries or an area within the planning area. Spatial boundaries were developed to facilitate the analysis and are included under the appropriate resource section heading.

5.1.2 Past, Present, and Reasonably Foreseeable Future Actions

Past, present, and reasonably foreseeable future actions are considered in the analysis to identify whether and to what extent the environment has been degraded or enhanced, whether ongoing activities are causing impacts, and trends for activities in and impacts on the area. Projects and activities are

evaluated on the basis of proximity, connection to the same environmental systems, potential for subsequent impacts or activity, similar impacts, the likelihood a project will occur, and whether the project is reasonably foreseeable.

Projects and activities considered in the cumulative analysis were identified through meetings held with cooperators and BLM employees with local knowledge of the area. Each was asked to provide information on the most influential past, present, or reasonably foreseeable future actions. Additional information was obtained through discussions with agency officials and review of publicly available materials and websites.

Effects of past actions and activities are manifested in the current condition of the resources, as described in the affected environment (see **Chapter 3**, Affected Environment). Reasonably foreseeable future actions are actions that have been committed to or known proposals that would take place within a 20-year planning period.

Reasonably foreseeable future action scenarios are projections made to predict future impacts – they are not actual planning decisions or resource commitments. Projections, which have been developed for analytical purposes only, are based on current conditions and trends and represent a best professional estimate. Unforeseen changes in factors such as economics, demand, and federal, state, and local laws and policies could result in different outcomes than those projected in this analysis.

Other potential future actions have been considered and eliminated from further analysis because there is a small likelihood these actions would be pursued and implemented within the life of the plan or because so little is known about the potential action that formulating an analysis of impacts is premature. In addition, potential future actions protective of the environment (such as new potential threatened or endangered species listings or regulations related to fugitive dust emissions) have less likelihood of creating major environmental consequences alone, or in combination with this planning effort. Federal actions such as species listing would require BLM to reconsider decisions created from this action because the consultations and relative impacts might no longer be appropriate. These potential future actions may have greater capacity to affect resource uses within the planning area; however, until more information is developed, no reasonable estimation of impacts could be developed.

Data on the precise locations and overall extent of resources within the planning area are considerable, although the information varies according to resource type and locale. Furthermore, understanding of the impacts on and the interplay among these resources is evolving. As knowledge improves, management measures (adaptive or otherwise) would be considered to reduce

potential cumulative impacts in accordance with law, regulations, and BLM RMPs.

Projects and activities identified as having the greatest likelihood to generate potential cumulative impacts when added to the RDEP alternatives are displayed in **Table 5-1**, Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions, and **Figure 5-1**, Existing and Proposed Renewable Energy, Transmission, and other Development.

Table 5-1
Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions

Human Actions	
Energy and minerals development	Northern Arizona Proposed Withdrawal Environmental Impact Statement. The Draft EIS was released for public comment in February 2011; BLM is reviewing comments and revising the Draft EIS based on comments. Proposed Action is to withdraw 1,010,776 acres of BLM and USFS federal locatable mineral estate in northern Arizona from the location of new mining claims under the General Mining Law of 1872.
	Active Mines/Pits/Plants – 153 (BLM 2011b)
Vegetation management	Forestry. Past, current, and foreseeable forestry uses include personal and commercial harvest of pinyon and juniper fuel wood, poles, and posts for fence building, wildings (live trees), and Christmas trees.
	Vegetation treatments. Mechanical treatments of vegetation (e.g., chaining, rollerchops, Dixie-harrow, drill seeding, hydro-axing, brush mowing) were very common in the past on public and private rangelands in the planning area. These treatments and maintenance of these vegetation treatments are still fairly common and will likely continue.
	Hazardous Fuels Reduction. Fuels treatments, including prescribed fires, chemical and mechanical treatment, and seeding, would likely continue and potentially increase in the future.
	Biomass. Future forestry use of woody biomass for energy production could occur.
Lands and realty	The BLM is moving toward the consolidation of BLM lands to benefit the public. To achieve this goal, candidates for land tenure adjustment through disposal, sale, or exchange include parcels that are difficult to manage or that do not have public access, relatively small parcels adjacent to other federal- or state-managed lands, parcels that would increase conservation of natural resources, and parcels that increase access and use of BLM lands. Residential development in the areas surrounding major metropolitan areas in Arizona has been increasing, and many state lands are being planned for master communities.
	Designation of Energy Corridors on Federal Lands in the 11 Western States Programmatic EIS (2007). This multi-federal agency Programmatic EIS analyzes the environmental impacts of designating federal energy corridors on federal lands in 11 western states and incorporating those designations into relevant land use and resource management plans.

Table 5-1 *(continued)*
Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions

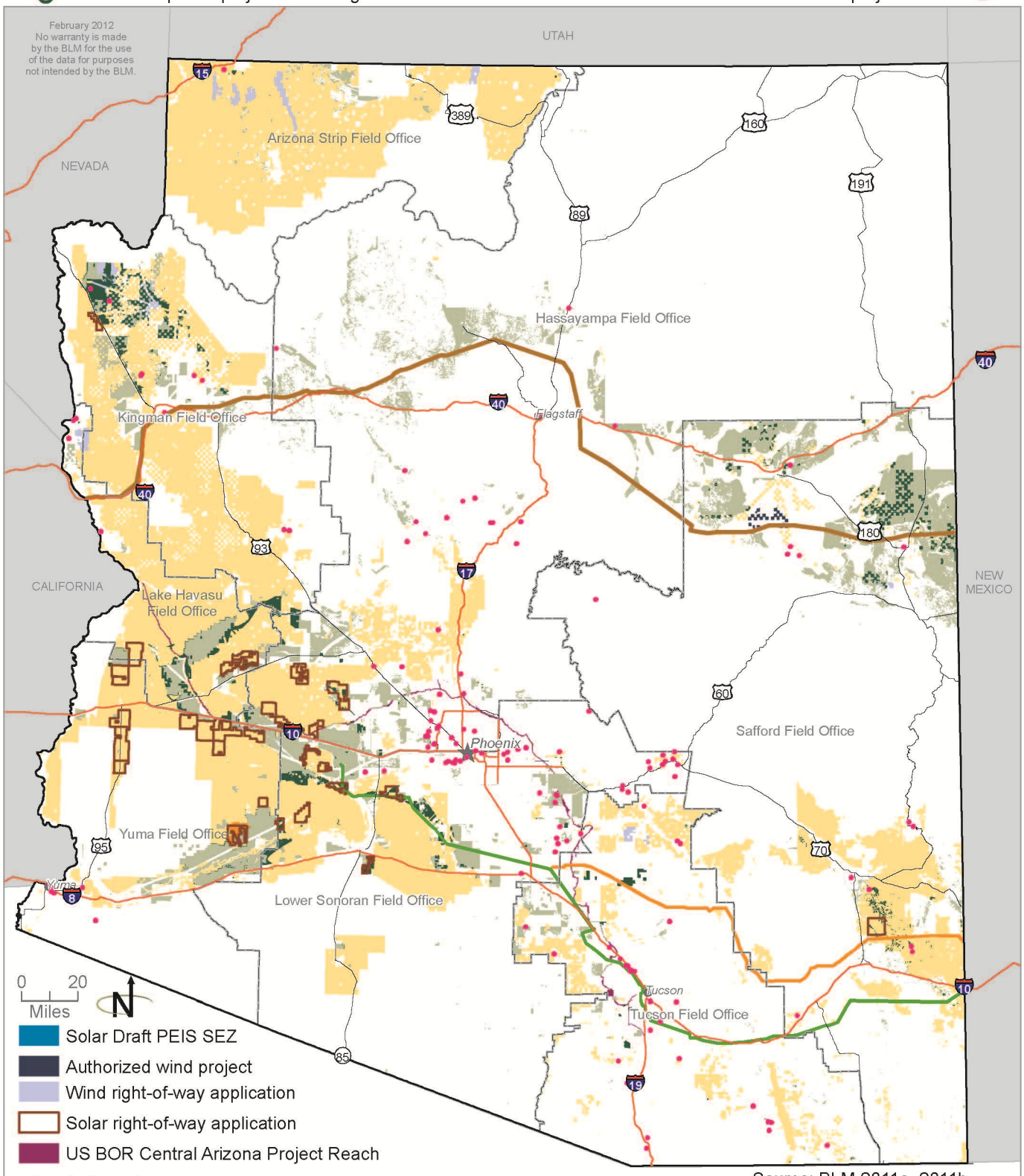
	Solar applications – 31 applications, totaling 463,587 acres
	Wind applications – 9 applications, totaling 172,018 acres
	Built wind projects – 1 (Dry Lake Wind Farm), totaling 12,918 acres
	Proposed Transmission lines greater than 230 kV – 3 proposals (SunZia, Southline, Centennial West), totaling approximately 1,859,000 acres
	Existing Transmission lines greater than 230 kV – approximately 1,900,000 acres
Recreation and visitor use	Arizona's population has grown significantly in the past 10 years, and an increasing number of people are living near or seeking local public lands for a diversity of recreational opportunities. The primary recreational activities in Arizona are motorized vehicle touring, big and small game hunting, backpacking, horseback riding, mountain biking, sight-seeing, pleasure driving, and hiking. Recreation-based visitor use in Arizona has increased in most areas in recent years and is expected to continue to increase on BLM and non-BLM lands.
Livestock grazing	Livestock grazing has a long history in the region. Generally, livestock use has decreased over the past 100 years. Grazing in portions of the Cumulative Impacts Analysis Area has either remained stable or declined in the recent past. Approximately 10.9 million acres of BLM-administered lands are open to grazing in the planning area; this represents approximately 89 percent of the BLM-administered land in the state. A total of 1.3 million acres (11 percent) are closed to grazing. Recent land use plan amendments have increased the number of acres closed to grazing due to other resource concerns. As of 2010, the total number of grazing permits and leases on BLM-administered lands in the planning area was 769, of which 405 were authorized as Section 3 permits, and 364 were authorized as Section 15 leases. A total of 635,731 AUMs have active status as of 2011. Grazing on private lands within the Cumulative Impact Analysis Area is expected to remain stable or slightly decrease as residential and industrial development increases. Based on the most recent BLM-administered land statistics for monitored rangeland, resource conditions on a total of 2.1 million acres in Arizona were determined to be improving, 3.6 million acres static and 640 thousand acres declining on public grazing lands in Arizona.
Roadway development	Road construction has occurred in association with timber harvesting, energy development, and mining on BLM lands, private lands, State of Arizona lands, and U.S. Forest Service lands. The bulk of new road building is occurring for community expansion and energy development. Road construction is expected to continue at the current rate on BLM and U.S. Forest Service lands; the future rate is unknown on private and State of Arizona lands.
Water diversions	The planning area and BLM-administered lands have been and will continue to be affected by irrigation and diversions for municipal and industrial (M&I) uses. A recent report by the Arizona Water Resources Development Commission projected that future agricultural water use will remain stable and increased demand for M&I to be met by conservation and new groundwater pumping (WRDC 2011). Reservoir operations have affected water supply, aquatic

Table 5-1 *(continued)*
Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions

	conditions, and timing. Irrigation rights are expected to continue being bought and sold in the future, with some new property owners changing how the right was historically used. Due to population growth and land sales, more agricultural water rights may be converted to municipal and industrial uses.
	Central Arizona Project (total) – 43,505 acres
	Natural Processes
Spread of noxious/invasive weeds	Noxious weeds have invaded and will continue to invade many locations in the planning area. Noxious weeds are carried by wind, humans, machinery, and animals. The Arizona BLM currently manages weed infestations through integrated weed management, including biological, chemical, mechanical, and educational methods. The 1991 and 2007 Records of Decision for Vegetation Treatment on BLM Lands in Thirteen Western States, and the 2007 Programmatic Environmental Report guide the management of noxious weeds in western states, including Arizona. Noxious and invasive weeds are expected to continue to spread on all lands. Due to their ability to tolerate certain conditions, some species are expected to remain a serious long-term challenge in Arizona.
Wildland fires	Fires within the planning area are both naturally occurring and used as a management tool. Naturally occurring fires have been widely distributed in terms of frequency and severity, and a number of major fires (e.g., the Wallow Fire that burned approximately 538,00 acres and the Horseshoe 2 fire that burned 222,950 acres) have occurred in the past decade. Increasing recurrence and severity of drought conditions have been predicted for this area as a result of climate change. This could, in turn, increase the occurrence and severity of wildfires on BLM land.
Drought	For much of the last decade, most of the Western US has experienced drought. Inflows to the Lower Colorado Basin have been below average since 2000, and Arizona regularly goes through periods of drought that may be statewide, region-wide, or within a more localized area. Agriculture, drinking water supplies, and wildland fires are all impacted by drought.
Climate change	Increased concern over greenhouse gas emissions and climate change issues may lead to future federal and state regulations limiting the emission of associated pollutants.

Existing and Proposed Renewable Energy, Transmission, and other Development

Proposed project data are generalized and not an authoritative source of the location of a project.



Source: BLM 2011a, 2011b

*Transmission lines are based upon proposed alignments and are subject to modification during the permitting and NEPA review process.

Figure 5-1

5.2 SCOPING COMMENTS ON CUMULATIVE IMPACTS

In addition to scoping comments related to direct and indirect impacts on resources, the BLM received public comments regarding cumulative impacts of renewable energy development and its associated infrastructure on a landscape scale. Following are the topics and issues that BLM will address in the cumulative impacts analyses:

- Commenters request that BLM comply with relevant CEQ guidance to analyze cumulative impacts.
- BLM should analyze cumulative impacts (including likely development of other energy resources) to land use, water, wildlife habitat, recreation, cultural resources, socioeconomics, visual resources, and other resources and values.
- BLM should produce a coordinated plan for additional legislative or administrative protection of lands alongside designation of development zones (similar to the California Desert Renewable Energy Conservation Plan).
- BLM should consider and analyze impacts on climate change, including anticipated benefits, from solar development.
- BLM should describe and estimate emissions from off-highway vehicle use and any mitigation measures to minimize those emissions. Emissions from off-highway vehicle use can be considered a cumulative impact on air quality.

5.3 RESOURCES AND RESOURCE USES

This section contains a description of the biological and physical resources and those resource uses of Arizona and follows the order of topics addressed in **Chapter 3**, Affected Environment and **Chapter 4**, Environmental Consequences.

5.3.1 Air Quality and Air Quality-Related Values

Impacts Common to All Alternatives

Cumulative impacts from past, present, and reasonably foreseeable actions have affected and could continue to affect air quality. Population growth and concentration have played a large role in determining the air quality in different parts of the planning area, with urban areas tending to have reduced air quality. In addition, past mining and industrial practices historically contributed to poor air quality conditions in some parts of the planning area. Improved understanding of the effects of human actions on air quality, regulation of sources of pollutant emissions, and the establishment of air pollution regulating agencies to manage the attainment status of a region have resulted in a trend towards improved air quality.

Solar, wind, and transmission line development, road development, wildland fire, and increased visitor use on BLM-administered lands all contribute to short-term or long-term impacts on air quality. Solar, wind, and transmission line development, road development, and other earth-disturbing development projects result in short-term particulate matter emissions that can combine with naturally occurring dust generation to create temporary cumulatively degraded visibility conditions. Approved solar energy development could disturb up to 5,684 acres, with 457,903 acres of additional solar applications pending. Solar development under each REDA alternative could affect another 76,000 acres state-wide, including 12,000 acres of BLM-administered land and 64,000 acres of non-BLM-administered land. Projects that occur simultaneously could contribute to violations of PM_{10} and $PM_{2.5}$ ambient air quality standards, with greatest potential cumulative effect in PM_{10} nonattainment and maintenance areas. Equipment and vehicle exhaust emissions during construction, though short term, contribute to regional ozone conditions. Operation of solar, wind, and transmission line development would have limited individual or cumulative effect on air quality.

Population growth in Arizona has and will likely continue to increase the demand for energy. Meeting the increased energy demand through renewable sources would limit the cumulative effect on air quality that would otherwise occur through the construction and operation of additional fossil fuel-burning power plants within the planning area.

Population growth also increases recreational use on public lands. This increased use increases dust emissions on unpaved roads, particularly from off-highway vehicle use, and increases exhaust-related emissions along travel routes. This increase in emissions may cumulatively affect air quality in public land areas, particularly in the form of fugitive dust and associated visibility impacts. The ability of resource management planning to reduce or avoid emissions associated with such use would determine the cumulative impact on air quality associated with use of public lands.

The effects of climate change on air quality could include increased dust generation in areas receiving less rainfall or undergoing more extreme drought conditions. To the extent that climate change increases the likelihood of wildland fire, this would also increase the impacts on regional air quality through generation of particulates.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives for the REDA, above. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis. Appropriate evaluation of cumulative impacts would be required during the ROW application process to determine the cumulative impacts associated with proposed solar and wind

energy development projects and to ensure that appropriate design measures and best management practices are implemented to reduce cumulative air quality impacts.

Impacts from Alternatives 1 through 6

Impact from REDAs

Impacts under each alternative would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts could result from the construction, operation, and decommissioning of solar energy development projects within the proposed Agua Caliente SEZ in combination with other past, present, and reasonably foreseeable future projects in the area. The level of effect would depend upon the size, number, and location of proposed solar projects and the types of technology that would be employed. There is one solar facility under construction adjacent to the proposed Agua Caliente SEZ, one pending solar application within the proposed SEZ, and three pending solar applications on BLM-administered lands within an approximately 20-mile radius of the proposed SEZ.

The most likely potential cumulative impacts associated with solar development would be short-term impacts related to construction from projects with overlapping construction periods. The level of this effect would be determined by the proximity of such projects to one another as well as the travel routes to access the sites by worker vehicles and delivery trucks. The development of multiple utility-scale solar facilities in the area could have a regional benefit by offsetting the need for energy production from oil, gas, and coal power plants that results in higher levels of criteria and toxic air pollutants.

Impacts from Alternatives 2 and 6, Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives, above. With a smaller SEZ area than described under Alternative I, the level of development is likely to be less, with fewer potential cumulative impacts on air quality.

Impacts from Alternative 5, Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives, above. With a smaller SEZ area than described under the other alternatives, the level of development is likely to be the least, with fewer potential cumulative impacts on air quality.

5.3.2 Greenhouse Gas Emissions and Climate Change

Impacts Common to All Alternatives

Past, present, and reasonably foreseeable future actions have and will continue to produce GHG emissions. In Arizona, GHG emissions have historically increased. Between 1990 and 2005, the net GHG emissions increased by nearly 56 percent, and GHG emissions are forecasted to increase by 148 percent by 2020. Electricity use accounts for nearly 40 percent of Arizona's gross GHG emissions (ACCAG 2006).

Solar, wind, and transmission line development, road development, and other earth-disturbing development projects result in short-term generation of GHG emissions from permanent removal of vegetation, which releases carbon stored (sequestered) in the cleared vegetation, and from fuel combustion associated with heavy construction equipment and vehicle and truck use. Greenhouse gas emissions associated with operation of solar and wind facilities would be much less than under construction and would not be a cumulatively significant contribution to other GHG-producing actions on BLM-administered lands or other private and public lands in the planning area. Operation of other reasonably foreseeable future actions would produce varying levels of GHG emissions depending on the nature of the action.

Population growth in Arizona has and will likely continue to increase the demand for energy. Meeting the increased energy demand through renewable sources would limit the production of GHGs that would otherwise be required through the construction and operation of oil, gas, or coal-fired power plants. In Arizona, an estimated 1,700 pounds of CO_2 would be displaced annually per megawatt-hour of renewable energy produced (EPA 2007). The proposed action and alternatives in combination with other reasonably foreseeable future renewable energy projects could help offset the increase in GHG emissions resulting from population growth.

The availability of additional renewable sources of energy resulting from proposed and reasonably foreseeable future renewable energy projects, together with any legislation aimed at controlling GHGs, would have an incremental cumulative effect on climate change.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives for the REDAs, above. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis. Appropriate evaluation of cumulative impacts would be required during the ROW application process to determine the cumulative impacts associated with proposed solar and wind energy development projects and to ensure that

appropriate design measures and best management practices are implemented to reduce emissions of GHGs.

Impacts from Alternatives 1 through 6

Impacts under each alternative would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred.

5.3.3 Cultural Resources

Cultural resources are finite, limited, and nonrenewable resources. The evaluation methodology for cumulative impacts on cultural resources is based upon the following:

- Location of the proposed REDAs;
- Proximity to water;
- Proximity to urban areas;
- Previous disturbance to the REDAs; and
- Relative amount of land in each REDA.

Assumptions include the following:

- The geographic scale of the cumulative area of effect is the entire state of Arizona.
- The Class I record searches that have been conducted for the REDAs were limited to NRHP-listed properties, and the actual number of previously recorded sites in each REDA is unknown.
- The direct effects of the RDEP planning project would not result in impacts on cultural resources, so the discussion of cumulative effects is focused on the indirect effects (i.e., the potential for ground-disturbing activities in the REDAs).
- The anticipated development of each REDA would be proportionate to the initial size of the REDA (i.e., a large REDA would have a larger proportion of the area be developed than other smaller REDAs).
- There are differences in impact levels between solar and wind renewable energy projects with regard to cultural resources, which would result in different kinds of cumulative impacts. Given that the future type of development is unknown, the cumulative impacts would be treated the same regardless of type of renewable energy project.
- It is assumed that no cultural resource studies have been completed for any of the REDAs. It is further assumed that prior to future ground-disturbing activities, studies would need to be completed to

meet Section106 compliance requirements. It is also assumed that appropriate mitigation procedures would be applied to address the adverse effects on-NHRP eligible sites.

Impacts Common to All Alternatives

Cultural resources are subject to loss during construction of solar and wind energy facilities and associated roads and transmission lines. Historic properties, including prehistoric and historic archaeological sites, structures, features, and traditional cultural properties, that have been listed in or are eligible for listing in the NRHP are of concern. The types of impacts would be the same as described in **Section 4.2.3**, Cultural Resources. Cumulative effects on cultural resources from foreseeable development in the planning area are expected to occur over a very small fraction of the total planning area. Of the several contributors to impacts on cultural and heritage resources noted in **Table 5-1**, Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions renewable energy development could be a major contributor to these impacts due to the amount of area usually involved in utility-scale energy production. However, facilities could, and would wherever possible, be sited away from areas rich in cultural resources due to the required design features that are proposed as part of the RDEP. Such areas would include individual properties (sites, structures, features, traditional cultural properties) and districts listed in the NRHP, National Historic Landmarks, National Historic Trails, and prehistoric and historic sites possessing significant scientific, heritage, or educational values. With more projects proposed and/or constructed, there would be more areas surveyed for cultural resources and new sites discovered, thereby adding to the historic record and making more scientific information available to help understand the region's cultural history.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives, above. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis. The trends in **Table 5-1**, Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions note that many of the factors that result in impacts on cultural resources will continue to increase, including increasing recreation demand, increasing road development and increasing renewable energy development, resulting in continued site discoveries, new scientific information added to the cultural records, and the increased likelihood for looting and vandalism.

Impacts from Alternative 1

Impacts from Maximum REDA

Alternative 1 would have cumulative effects of the type and nature described above due to the location of the components of the REDA includes a larger land area, and the alternative is close to urban centers, water, and near areas that

have high sensitivity for cultural resources. Given these reasons, Alternative 1 would have a substantial indirect impact on significant cultural resources.

Impacts from Proposed Agua Caliente Solar Energy Zone
The project would have cumulative effects of the type described above in the proposed Agua Caliente SEZ due to the fact that there are large World War II military training ranges that have the potential to be impacted by this alternative. In addition, private and state lands adjacent to the SEZ along the lower Gila River would be identified as REDAs, allowing for further potential development and impacts on cultural resources.

Impacts from Alternative 2
Impacts from Transmission Line and Utility Corridor REDA
Alternative 2 would have less of a cumulative effect on cultural resources since the ground-disturbing activities would be directed to areas that have been previously disturbed or will be disturbed through the construction of existing and future transmission projects.

Impacts from Proposed Agua Caliente Solar Energy Zone
The project would have a cumulative effect on cultural resources in the Agua Caliente Solar Energy Zone as described under Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
Alternative 3 would have a greater cumulative effect than Alternatives 2, 4, 5, and 6 given its proximity to urban centers. As mentioned previously, urban localities in Arizona have significant historic resources that could be impacted by the development of this alternative.

Impacts from Proposed Agua Caliente Solar Energy Zone
The project would have a cumulative effect on cultural resources in the Agua Caliente Solar Energy Zone as described under Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Alternative 4 would have less of a cumulative effect on cultural resources than Alternatives 1, 2, and 3. Significant cultural resources are generally located in close proximity to water (i.e., large habitation areas). Therefore, the removal of these water areas from the REDA would result in a lower cumulative effect on cultural resources.

Impacts from Proposed Agua Caliente Solar Energy Zone
The project would have a cumulative effect on cultural resources in the Agua Caliente Solar Energy Zone as described under Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Alternative 5 would have less of a cumulative effect on cultural resources than other alternatives. This alternative encompasses areas that have already been disturbed or have low potential for resources to be present. Therefore, the cumulative effect of the development of this alternative on cultural resources is insignificant.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

The cumulative effects on cultural resources for Alternative 6 would be less than the other alternatives because it combines areas that have the least impact on resources.

Impacts from Proposed Agua Caliente Solar Energy Zone

The project would have a cumulative effect on cultural resources in the Agua Caliente Solar Energy Zone as described under Alternative 1.

5.3.4 Energy and Minerals

Impacts Common to All Alternatives

The primary indicators of impacts on the availability of mineral resources are the amount of land made unavailable for mineral resource activities and the restrictions that may be placed on mineral claiming, leasing, or development activities. Potential impacts on the availability of mineral resources could occur if the proposed alternatives in combination with past, present, and reasonably foreseeable future actions resulted in a substantial reduction in federal leasing and development of oil and gas or potash or a substantial reduction in exploration for or development of locatable or salable minerals. Cumulative impacts from past, present, and reasonably foreseeable actions, such as mineral exploration and development activities and management actions that withdraw lands from mineral entry, have affected and could continue to affect the availability of mineral resources.

Leasable Minerals

As noted in **Chapter 4,** Environmental Consequences under all alternatives, the impacts on oil, gas, and geothermal development from solar and wind energy development is expected to be negligible. Also, lands with potential for potash development have been eliminated from consideration as the REDA making the impact on potash development negligible. As the impact on leasable minerals is expected to be negligible under all alternatives, no cumulative impact is anticipated.

Locatable Minerals

As noted in **Chapter 4,** Environmental Consequences the elimination of metallic mineral districts and areas with high potential of known mineral

deposits from consideration minimizes the impacts on the availability of locatable minerals from solar and wind energy development under all alternatives. However, cumulative impacts on the availability of mineral resources could occur if future actions result in lands being withdrawn from mineral entry (e.g., the proposed northern Arizona uranium withdrawal currently under NEPA analysis) or if solar and wind energy development, including right-of-ways, restrict new mineral development activities.

Saleable Minerals

Cumulative impacts may occur if solar and wind energy development combined with other future actions restricts the availability of saleable minerals on a local or regional scale over the short or long term. However, as the known occurrences and prospects for saleable minerals are abundant and wide spread, the cumulative impacts on the availability of saleable minerals under all alternatives is expected to be negligible.

For all mineral resources, the increased development of renewable energy could potentially restrict the availability of mineral resources on public or private lands since the intensive coverage of land surface required by solar and wind energy facilities may render the land used incompatible for other uses such as mineral development. Additionally, an increase in renewable energy could potentially slow the growth of the nonrenewable energy sector by reducing the need for nonrenewable sources of fuel (e.g., coal, oil, and gas).

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives for the REDAs, above.

Impacts from Alternatives 1 through 6

Impacts under each alternative would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred.

Impacts from Proposed Agua Caliente Solar Energy Zone

As discussed in **Section 4.2.4**, Energy and Minerals there are currently no active oil and gas or geothermal leases within the proposed SEZ, and there are no mining claims or active mines. There is one pending solar application within the proposed SEZ and three pending solar applications on BLM-administered lands within an approximately 20-mile radius of the proposed SEZ. There are currently no wind or geothermal applications within this distance. Because of the generally low level of mineral production in the proposed SEZ and surrounding area and the expected low impact on mineral accessibility of other foreseeable actions within the geographic extent of effects, no cumulative impacts on mineral resources are expected.

5.3.5 Environmental Justice

Impacts Common to All Alternatives

Environmental justice is concerned with addressing disproportionately high and adverse human health or environmental effects of agency programs, policies, and activities on minority and low-income populations. Four counties in the planning area contain minority populations as defined by CEQ guidance (Apache, Navajo, Santa Cruz, and Yuma). Cumulative impacts could occur were these populations to be disproportionally affected by development. Past, present, and reasonably foreseeable future actions and conditions within the planning area that have affected and will likely continue to affect environmental justice include those described for socioeconomics, below. Potential effects on environmental justice may arise from air pollution, noise, land use, cultural, or socioeconomic impacts. These effects may be negative, as in the case of increased noise levels or altered land use patterns, or positive, as in the case of local or regional economic benefits resulting from increased jobs and revenue.

Impacts from renewable energy construction would be short-term and therefore not likely cumulative for any of the planning area. Operations and maintenance impacts would be minimal, as post-construction, overall demands for site operations and maintenance would be minimal. Cumulative impacts could result from the long-term implications of the presence of renewable energy in the area: noise from transmission lines, changes in public land access, visual changes to the environment, and changes in local community economic resources or social structure. Mitigation measures would reduce potential impacts.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which would contribute to cumulative impacts on environmental justice if approved.

Impacts from Alternatives 1 through 6

Impacts from REDAs

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Cumulative effects on environmental justice populations from renewable energy development would likely be negligible, due to the sparse populations in solar and wind development areas, measures included in design features and BMPs which minimize potential threats to human health and mitigate impacts on air quality and noise. Additional measures provide requirements to involve local communities in the development process.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. A significant minority population was found through the study of county and census tract data for the proposed SEZ, though the SEZ is located away from large population centers. Fugitive dust, traffic, noise, and visual impacts could affect minority populations in the short term, but the contribution to cumulative impacts is likely to be negligible after the implementation of design features and BMPs. Development of the SEZ may provide a minor cumulative contribution to employment for environmental justice population areas in the region due to construction and operations employment needs.

5.3.6 Fish and Wildlife

Impacts Common to All Alternatives
Potentially affected wildlife in the planning area includes numerous species of amphibians and reptiles, birds, mammals, and aquatic biota. Impacts would vary by species. Special status species are discussed further in **Section 5.3.16**, Special Status Species. Past, present, and reasonably foreseeable future actions and conditions within the planning area that have affected and will likely continue to affect fish and wildlife habitat include but are not limited mineral exploration and energy development, vegetative treatments, livestock grazing, recreation, road construction and utility corridor development, water diversions such as the Central Arizona Project (CAP), commercial and residential development, prescribed and wildland fires, land planning efforts, and habitat improvement projects. Site-specific effects would depend on the affected habitat, species present, and extent of disturbance. In general, resource use activities that alter habitat or increase human presence may change habitats so that they are no longer suitable for particular fish or wildlife species. Activities that may enhance wildlife habitat or increase protection for fish and wildlife include designation of protective areas such as wildlife refuges, or development of long-term management plans for specific species or habitats.

Approved solar energy development could cause up to 5,684 acres of habitat removal. Additionally, 457,903 acres of additional solar applications are pending. Most solar energy development has been proposed in the southwestern portion of the state within the Yuma, Lower Sonoran, and Lake Havasu Field Offices. Habitat within the approved and pending solar applications is primarily lower and upper Sonoran desert scrub, therefore fish and wildlife species within this habitat are the most likely to be impacted. Wind energy has been developed on 12,918 acres throughout Arizona with pending wind applications totaling an additional 172,018 acres; a small portion of that acreage (estimated at 10 percent) would likely be permanently lost as wildlife habitat. Transmission line development would cause the disturbance of a corridor around lines and permanent removal of habitat in small areas associated with pole or tower structures. Total proposed transmission lines may cover around 1,859,000 acres

and existing transmission has disturbed an additional 1,900,000 acres. Renewable energy facilities on all lands in the planning area could affect bird migration patterns. Transmission towers and site infrastructure could provide nesting and perching sites for predators such as ravens and raptors. Site infrastructure for wind power plants present collision hazards to birds and bats. Aquatic species could be affected by changes in drainage patterns due to site grading and infrastructure. In addition, depletion of groundwater would impact riparian and wetland areas as well as streams, seeps, and other areas hosting aquatic species.

Climate change could cause an increase or decrease in temperatures and precipitation, which would affect vegetation conditions and water availability and thus alter habitat suitability conditions.

Stipulations and permitting requirements, including timing and no surface occupancy limitations, would minimize the impacts associated with development. There could be a cumulative effect from removal of small patches of habitat that can add up to a notable acreage and fragment suitable habitat and movement corridors.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives above. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which would contribute to cumulative impacts on fish and wildlife if approved. Without development of the REDA, solar and wind energy development may be scattered throughout the planning area, and approval of such applications may contribute to the cumulative fragmentation of habitats and movement corridors.

Impacts from Alternative 1

Impacts from Maximum REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 1 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. Depending on the location and technology that would be developed, fish and wildlife habitat could be removed or fragmented over large areas and over the long term.

Design features to address impacts include but are not limited to timing of activities to avoid affecting breeding seasons and winter use areas, use of noise reduction devices, use of fencing to protect wildlife, traffic control, and

preservation of wetlands. These design features would reduce but not eliminate the contribution to cumulative impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 1 would cover 20,600 acres and would contribute to the loss of potential wildlife habitat within Arizona.

Impacts from Alternative 2
Impacts from Transmission Line and Utility Corridor REDA
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 2 would contribute to cumulative impacts by making 218,600 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,680,600 acres of non-BLM-administered lands that could be suitable for renewable energy development. Impacts from transmission line construction would be reduced under this alternative, since the REDA would be sited close to existing transmission lines and utility corridors.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives above. The proposed Agua Caliente SEZ under Alternative 2 would cover 6,770 acres and would contribute to the loss of potential wildlife habitat within Arizona.

Impacts from Alternative 3
Impacts from Load Offset REDA
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 3 would contribute to cumulative impacts by making 129,800 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,737,000 acres of non-BLM-administered lands that could be suitable for renewable energy development. Depending on the technology that would be developed, fish and wildlife habitat could be removed or fragmented over large areas and over the long term. Utility-scale development may be more likely under this alternative due to siting of projects nearer to load centers. Therefore, impacts may be concentrated on larger tracts of land.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The

proposed Agua Caliente SEZ under Alternative 3 would cover 2,760 acres and would contribute to the loss of potential wildlife habitat within Arizona.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 4 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. Impacts, such as changes in habitat conditions, would be reduced under this alternative, as the REDA is sited to protect groundwater resources.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 4 would be similar to those described for Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives above. Alternative 5 would contribute to cumulative impacts by making 43,700 acres of BLM-administered lands available for solar and wind energy development.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 6 would contribute to cumulative impacts by making 237,100 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,795,300 acres of non-BLM-administered lands that could be suitable for renewable energy development. Alternative 6 would reduce cumulative impacts on fish and wildlife by combining the protective features of all the alternatives. This would reduce new habitat disturbance, removal, and fragmentation from renewable energy development.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 6 would be similar to those described for Alternative 2.

5.3.7 Land Use and Realty

Impacts Common to All Alternatives

Contributions of renewable energy development to cumulative impacts on land use and realty would be in addition to those from other ROWs for transmission lines, roads, and other facilities on public lands and from other energy development on public and private lands that would further affect and limit other land uses within a given region. The intensive coverage of land surface required by solar facilities renders the land used incompatible for most other uses, including grazing, mineral development, and recreation. Although wind facilities also encompass large areas, they are generally more compatible with such other uses, because they require less land and can accommodate multiple uses.

The magnitude of land use effects from solar development could be fairly large locally, but smaller on a statewide basis. On a local scale, solar facilities would dominate several square miles of land lying in basin flats and would introduce an industrial land use in an otherwise rural area. On a statewide basis, while facilities would affect areas of similar topography, thus increasing their relative impacts on such land types, the percentage of such land types affected would remain quite small for the amount of land required to meet the RFDS.

Cumulative impacts would be associated with changes in existing uses on public, state, and private lands that are converted to solar or wind energy, or are near solar and wind energy facilities. Indirect impacts could include conversion of land in and around local communities from agricultural, open space, or other uses to solar or wind facilities, or to provide services and housing for employees and families who move to the region in support of solar or wind energy development on public and private lands.

Renewable energy development, transmission lines and facilities, and urban development are the most likely new future uses of rural lands. Solar energy development, because of its intensive land use and outstanding resource potential in Arizona, would be a major contributor to those impacts; more so than wind energy developments due to its lesser quality resource potential.

There is potential for impact on land values in areas near solar energy facilities and associated ROWs. Some reasons that land values could be reduced include aesthetic concerns, changes in the amount of vehicular traffic, or changes in current operations (e.g., the removal of a substantial or critical part of a grazing operation). Alternatively, land values could increase because of additional demand for developable private lands to support solar and wind development. The increase in land value would likely increase the local tax base (see **Section 4.2.16**, Socioeconomics, for additional detail).

Impacts from Alternatives 1 through 6

The type of impacts under each alternative would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred. **Table 5-2**, Summary of Developable Land summarizes the type of public and private lands potentially impacted by future solar and wind energy development in the REDA based on screening and mapping.

Table 5-2
Summary of Developable Land

Agency	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
BLM	321,500	218,600	129,800	321,500	43,700	237,100
Forest Service	4,100	1,600	1,600	4,100	0	2,500
BOR	13,500	13,200	9,800	13,500	0	13,400
State	878,600	646,200	439,200	878,400	0	687,400
County	2,300	2,100	300	2,300	0	2,200
Local	1,500	1,400	1,400	1,500	0	1,500
Private	1,418,100	984,600	650,400	1,418,100	0	1,051,900

Renewable Energy

The primary indicator of impacts on renewable energy is whether an alternative restricts the availability of BLM-administered lands to a level below that of the acreage estimated in the RFDS Report (see **Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona) anticipated to be developed by 2025. The RFDS Report estimates that 15,600 acres of BLM-administered lands would be developed to produce a total of 1.63 GW of electrical capacity from wind and solar energy. None of the alternatives would result in changes to land use allocations that would preclude renewable energy projects.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts would result from the construction, operation, and decommissioning of solar energy development projects within the proposed Agua Caliente SEZ when added to other past, present, and reasonably foreseeable future actions described in **Section 5.1.2**, Past, Present, and Reasonably Foreseeable Future Actions. Because of the uncertain nature of future projects in terms of size, number, and location within the proposed Agua Caliente SEZ, and the types of technology that would be employed, the impacts are discussed qualitatively.

Development of the proposed Agua Caliente SEZ for utility-scale solar energy production would expand industrial areas that are currently under development and would exclude many existing and potential uses of the land. Since the area already includes one large solar facility that is under construction and one large-capacity transmission line, utility-scale solar energy development within the

proposed Agua Caliente SEZ would not introduce a new land use in the area; instead, any additional development would convert rural land to industrial use. It also is possible that state and private lands located adjacent to the proposed Agua Caliente SEZ, with landowner agreement, would be developed in a similar or complementary manner as the public lands.

The development of utility-scale solar projects in the proposed Agua Caliente SEZ in combination with other past, ongoing and foreseeable actions within a 20-mile geographic extent of effects could result in small cumulative effects on land use through impacts on land access and use for other purposes (primarily recreation), on groundwater availability, and on visual resources, especially if the proposed Agua Caliente SEZ is fully developed with solar facilities. Cumulative impacts on land use could rise if a large portion of the pending solar applications in the region were to result in actual projects, but projects within the proposed Agua Caliente SEZ would make only a small contribution to regional cumulative impacts because of its size.

5.3.8 Livestock Grazing

Impacts Common to All Alternatives

Approximately 10.9 million acres of BLM-administered lands are open to grazing in the planning area; this represents approximately 89 percent of the BLM-administered land in the state. As discussed in **Section 3.9**, Livestock Grazing, a historically important land use in the planning area, has demonstrated a trend towards decreased number of permits and leases. Cumulative impacts on livestock grazing are those that affect available forage, water, and land available for grazing. Past, present, and reasonably foreseeable future actions and conditions within the planning area that have affected and will likely continue to affect livestock grazing include loss of grazing lands to other resource uses such as recreation or energy development, vegetation treatments, and wildlife habitat enhancement, as well as a gradual reduction of suitable available land due to land disposal, wildfire, drought, and urban and commercial development.

Impacts on livestock grazing from renewable energy development would be dependent upon the site-specific development in relation to existing permits and leases. Approved solar energy development could cover to 5,684 acres, and solar applications covering an additional 457,903 acres are pending. Impacts from development include disruption of livestock movement or access to water sources. Much of the proposed development is concentrated in the Yuma, Lower Sonoran, and Lake Havasu Field Offices in the Sonoran Desert. Due to lack of forage vegetation for much of the habitat in this area, the number of affected allotments may be small or limited to ephemeral leases. Wind energy development and transmission lines may be compatible with livestock grazing for much of the site. Wind energy has been developed on 12,918 acres throughout Arizona with pending wind applications totaling an additional 172,018 acres; a small portion of that acreage would not be compatible with livestock grazing.

Similarly, transmission line development would cause potential disturbance of grazing areas during construction and the permanent removal from suitability of small areas associated with pole or tower structures.

In addition, climate change could cause an increase or decrease in temperatures and precipitation, which would affect soil conditions, vegetative health, and water flows and temperature. Such changes would potentially alter forage available for livestock grazing and the AUMs that public lands may support. The proposed RDEP program would not exacerbate climate change impacts, as the program would contribute to the availability of renewable sources of energy.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which would contribute to cumulative impacts on livestock grazing if approved.

Impacts from Alternative 1

Impacts from Maximum REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 1 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. A total of 1,511,800 acres of grazing allotments are located within the REDA. Depending on the location of development and the technology that would be developed, forage for livestock grazing could be removed, water sources diminished, and allotments lost or decreased in acreage.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 1 would cover 20,600 acres all of which is within an ephemeral grazing allotment, therefore impacts on livestock grazing would be negligible.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives above. Alternative 2 would contribute to cumulative impacts by making 218,600 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,680,600 acres of non-

BLM-administered lands that could be suitable for renewable energy development. A total of 1,101,500 acres of grazing allotments are located within the REDA. Depending on the location of development and the technology that would be developed, forage for livestock grazing could be removed, water sources diminished, and allotments lost or decreased in acreage. Impacts from transmission line construction would be reduced under this alternative, since the REDA would be sited close to existing transmission lines and utility corridors.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives above. The proposed Agua Caliente SEZ under Alternative 2 would cover 6,770 acres, all of which is within an ephemeral grazing allotment; therefore, impacts on livestock grazing would be negligible.

Impacts from Alternative 3

Impacts from Load Offset REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 3 would contribute to cumulative impacts by making 129,800 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,121,500 acres of non-BLM-administered lands that could be suitable for renewable energy development. A total of 764,300 acres of grazing allotments are located within the REDA. Depending on the technology that would be developed, forage for livestock grazing could be removed and allotments lost or decreased in acreage.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 3 would cover 2,760 acres, all of which is within an ephemeral grazing allotment; therefore, impacts on livestock grazing would be negligible.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 4 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. A total of 1,511,800 acres of grazing allotments are located within

the REDA. Depending on the location of development and the technology that would be developed, forage for livestock grazing could be removed and allotments lost or decreased in acreage. Impacts on water availability would be reduced under this alternative, however, as the REDA is sited to protect groundwater resources.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 4 would be similar to those described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 4 would contribute to cumulative impacts by making 43,700 acres of BLM-administered lands available for solar and wind energy development. A total of 42,100 acres of grazing allotments are located within the REDA. Because this alternative focuses on lands suitable for disposal, there is the potential that high-value grazing lands would be less likely to be affected.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 6 would contribute to cumulative impacts by making 237,100 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,795,300 acres of non-BLM-administered lands that could be suitable for renewable energy development. A total of 1,191,600 acres of grazing allotments are located within the REDA. Alternative 6 would reduce cumulative impacts on disturbance of livestock, and forage, water, and land available for livestock grazing by combining the protective features of all the alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 6 would be similar to those described for Alternative 2.

5.3.9 Native American Interests and Heritage Resources

Impacts Common to All Alternatives
Renewable energy development areas lie on or near lands of current and historical interest to numerous Native American tribes. Renewable energy facilities could be of concern to tribes because of visual, aural, or atmospheric settings of traditionally important places, which would be dramatically altered by solar or wind facilities. Other resources of concern include trails, sacred sites, and burial sites, as well as traditionally collected plants and game. Water bodies

and aquatic habitats are also of concern. Consultation with affected tribes is required prior to siting and construction of wind or solar facilities.

Mitigations of impacts would involve any and all mitigations otherwise identified for the affected resources. It may be difficult to mitigate impacts on places or resources that are important in sustaining traditional beliefs or practices. In consulting with Indian tribes to address the mitigation of adverse impacts in such cases, BLM may consider creative approaches proposed at the Tribal Summit on Renewable Energy, sponsored by the Advisory Council on Historic Preservation at Palm Springs, California, in January 2011. Potential options for mitigation include support for museum exhibits or native language revitalization programs; funding of ethnographic studies; restoration or interpretive development of sites within or near the project area; funding of regional studies to address cumulative impacts; or support for tribal scholarship programs for cultural resource management training. Such mitigation measures would be considered in consultation with tribes, the SHPO, and the project applicant.

Cumulative impacts on Native American concerns from foreseeable development in Arizona are currently unknown as consultation is still ongoing. However, many tribes are concerned that the cumulative impacts of multiple, large renewable energy projects could disrupt extensive areas of their traditional territories and the associated cultural values. Renewable energy development could make a significant contribution to impacts, when considered with other types of developments such as mining or planned communities. Other future development that would affect the visual landscape, ecological communities, water resources, or cultural resources would also contribute to cumulative impacts.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives, above. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis. The trends in **Table 5-1**, Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions note that many of the factors that result in impacts on tribal interests and heritage resources will continue to increase (e.g., increasing recreation demand, increasing road development and increasing renewable energy development), resulting in continued visual, aural, and atmospheric intrusions to the landscape setting.

Impacts from Alternatives 1 through 6

Although the nature and types of impacts would be similar as those described under Impacts Common to All Alternatives, development would be directed away from many areas of traditional use. Specifically, the REDAs would reduce the cumulative impacts on traditional territories by focusing development on areas of relatively low resource sensitivity (as opposed to the No Action Alternative) and in disturbed zones or areas near existing infrastructure.

5.3.10 Noise

Impacts Common to All Alternatives

Solar and wind energy facilities generally would be sited in rural areas within Arizona with few sensitive receptors nearby (with the possible exception of Alternative 3, which would develop facilities closer to load centers). Ambient noise levels in these areas are likely to be low and characterized by naturally produced sounds such as wind, by traffic on area roads and trails, and by aircraft overflights. Few stationary noise-sensitive receptors are likely to be present, though recreationists on BLM-administered lands could be present in the vicinity of renewable energy facility locations.

Solar, wind, and transmission line development, road development, and increased visitor use on BLM-administered lands would contribute to short-term or long-term impacts on the acoustic environment. Solar, wind, and transmission line development, road development, and other earth-disturbing development projects would result in a short-term increase in ambient noise levels; the proximity of the projects and construction timing would determine the degree of the cumulative short-term noise impacts. Cumulative noise impacts could occur on area roadways if multiple projects caused a marked short-term or long-term increase in traffic along these roadways. Operation of solar facilities and transmission lines would have limited individual or cumulative noise impact. Noise sources associated with renewable energy facilities are described in **Section 3.12**, Noise.

Noise resulting from other reasonably foreseeable future actions such as increased recreational use of public lands could elevate daytime ambient noise levels both on public lands and along public roadways used to access these lands. Noise-generating use in these areas are unlikely to combine with noise from operation of renewable energy projects, though there is the potential for an incremental noise increase along travel routes from recreational users and workers commuting to renewable energy facilities.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives for the REDAs. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis. Appropriate evaluation of cumulative impacts would be required during the ROW application process to determine the cumulative impacts associated with proposed solar and wind energy development projects and ensure that appropriate design measures and best management practices are implemented to avoid or reduce cumulative noise impacts.

Impacts from Alternatives 1 through 6

Impacts from REDAs

Impacts under Alternatives 1, 2, 4, 5, and 6 would be the same as those described under Impacts Common to All Alternatives, regardless of where development occurred.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative noise impacts under Alternatives 1, 3, 4, and 5 could result from the construction, operation, and decommissioning of solar energy development projects within the proposed Agua Caliente SEZ in combination with other past, present, and reasonably foreseeable future projects in the area. There is one pending solar application within the proposed Agua Caliente SEZ and three pending solar applications on BLM-administered lands within an approximately 20-mile radius of the proposed Agua Caliente SEZ. Development of these projects would have a cumulative impact depending upon construction schedule and proximity to one another. Because there are limited sensitive receptors in or near the SEZ, cumulative impacts would likely focus on short-term noise increases along travel routes to access the sites by worker vehicles and delivery trucks.

Impacts from Alternative 2 and 6

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. With a smaller SEZ area, the level of development is likely to be less, with fewer potential cumulative noise impacts.

Impacts from Alternative 3

Impacts from Load Offset REDA

Cumulative noise impacts would be similar to those described above for Impacts Common to All Alternatives. Limiting development to within 10 miles of load centers could encourage development closer to populated areas, resulting in potential short-term cumulative noise impacts on sensitive receptors depending upon what other reasonably foreseeable future actions were occurring in the area.

5.3.11 Paleontological Resources

Evaluation Methodology, Resource Indicators, and Assumptions

Paleontological resources are finite, limited, and nonrenewable. The assumptions for cumulative impacts on paleontological resources include the following:

- The direct effects of the project would not result in impacts on paleontological resources, so the discussion of cumulative effects is focused on the indirect effects (i.e., the potential for ground-disturbing activities in the REDAs).

- It is assumed that no paleontological resource studies have been completed for any of the REDAs. It is further assumed that prior to future ground-disturbing activities, studies would need to be completed and that appropriate mitigation procedures would be applied to address any adverse effects on paleontological resources.

Impacts from the No Action Alternative

There would be no cumulative impacts on paleontological resources as a result of the No Action Alternative.

Impacts from Alternative 1

Impacts from Maximum REDA

Alternative 1 would not have cumulative impacts on paleontological resources because paleontological resources are generally localized. Paleontological resources vary according to the geological units that contain them. Geological units may vary over short distances, effectively limiting the geographic range of any impacts on specific paleontological resources. Therefore, potential impacts on paleontological resources associated with the development of one renewable energy generation project would be unlikely to have cumulative impacts on paleontological resources associated with the development of another project. Any reasonably foreseeable future projects with potentially significant impacts on paleontological resources would be required to comply with federal and state regulations and ordinances protecting paleontological resources. Non-BLM-administered lands included in the planning area of Alternative 1 would include 1,127,900 acres of land with geological units assigned to PFYC Levels 3, 4, or 5 (Moderate/Undetermined to High Sensitivity).

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Agua Caliente SEZ has a low to undetermined potential for paleontological resources. Alternative 1 would, therefore, not have a cumulative impact on paleontological resources in the area of the Agua Caliente SEZ.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Cumulative impacts would be similar for Alternative 2 as those that would occur under Alternative 1, as described above, and would include 633,600 acres of non-BLM-administered lands with geological units assigned to PFYC Levels 3, 4, or 5 (Moderate/Undetermined to High Sensitivity).

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts would be the same for Alternative 2 as those that would occur under Alternative 1, as described above.

Impacts from Alternative 3

Impacts from Load Offset REDA

Cumulative impacts would be similar for Alternative 3 as those that would occur under Alternative 1, as described above, and would include 405,900 acres

of non-BLM-administered lands with geological units assigned to PFYC Levels 3, 4, or 5 (Moderate/Undetermined to High Sensitivity).

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts would be the same for Alternative 3 as those that would occur under Alternative 1, as described above.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Cumulative impacts would be similar for Alternative 4 as those that would occur under Alternative 1, as described above, and would include 766,500, 138,000, and 193,900 acres of non-BLM-administered lands with geological units assigned to PFYC Levels 3, 4, or 5 for Water Protection Levels 1, 2, and 3, respectively (Moderate/Undetermined to High Sensitivity).

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts would be the same for Alternative 4 as those that would occur under Alternative 1, as described above.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Cumulative impacts would be similar for Alternative 5 as those that would occur under Alternative 1, as described above.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
Cumulative impacts would be similar for Alternative 6 as those that would occur under Alternative 1, as described above, and would include 353,000, 127,700, and 190,600 acres of non-BLM-administered lands with geological units to PFYC Levels 3, 4, or 5 for Water Protection Levels 1, 2, and 3, respectively (Moderate/Undetermined to High Sensitivity).

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts would be the same for Alternative 6 as those that would occur under Alternative 1, as described above.

5.3.12 Recreation and Travel Management

Impacts Common to All Alternatives
Under the REDA alternatives, special recreation management areas have been excluded from solar development, so these areas could be affected only indirectly by renewable energy facilities located close to their boundaries. Special recreation management areas are identified as public lands with many of the BLM's most well-known and highly used recreational opportunities, so excluding special recreation management areas from solar or wind development would limit the significance of impacts on recreation. High levels of intensive recreational use generally do not occur within the basin flats suitable for solar

development but can occur in more broken or hilly terrain where wind developments may be feasible. The presence of solar or wind facilities would affect mainly off-highway vehicle (OHV) use and low levels of hunting, camping, and photography. In addition, access to recreational areas could be restricted by renewable energy facilities. The level of renewable energy development projected by the RFDS would occupy a relatively small portion of the BLM-administered lands in the planning area. Since alternative locations for such recreation are generally abundant within Arizona, direct impacts from facilities on the overall availability of recreation opportunities are anticipated to be low. Future site-specific analyses for project facilities would identify measures that would reduce anticipated impacts on local recreational use patterns and public access needs, which would further mitigate potential impacts on recreation opportunities. Other renewable energy facilities would also affect areas of low recreational use, as would most other types of foreseeable development in the region, including mining, agriculture, and linear transmission facilities. Thus, cumulative impacts on recreation from foreseeable development are expected to be small.

Effects on the transportation systems would occur mainly during construction of facilities and would affect primarily local road systems and traffic flow. Such effects would be temporary and could be mitigated through minor road improvements at access points and through reduction in traffic congestion through carpooling and coordination of shift changes. Only minor contributions to cumulative effects on transportation would be expected in the planning area during the development of solar facilities. Because of the small number of workers required to operate renewable energy facilities and the relatively low level of delivery traffic to and from facilities required for operation, cumulative impacts on transportation systems during facility operations would be minimal. There is also the potential to sever, alter or improve existing access routes due to new development, potentially requiring construction of new or realigned access routes. Increased traffic and access to previously remote areas also could change the overall character of the landscape, including the visual quality of large areas.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind energy projects would be developed on a case-by-case basis in accordance with current BLM land use plan decisions. In the absence of identifying the REDA, solar and wind project development would likely result in fragmented and segregated land uses and access, and thereby have a greater impact on recreation than if development was more coordinated and concentrated. Because recreation is the management focus in special recreation management areas, those areas are unlikely to experience solar and wind energy developments, but other undesignated areas of high recreational value may experience a decline in recreational access and experiences through future energy development.

Impacts from Alternatives 1 through 6

Impacts from REDAs

The nature and types of impacts under each alternative would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred. However, there are slight differences in location of REDAs that would either increase or decrease the intensity of the cumulative impacts. For example, Alternative 3 focuses REDAs within specific radius around load centers, including towns and cities. By keeping development in close proximity to cities and/or towns regardless of jurisdiction or administrative responsibilities, there could be more rural, open space areas available for recreational experiences.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under all alternatives, the area covered by the proposed Agua Caliente SEZ is located within a portion of the Yuma East Undeveloped Special Recreation Management Area. This area provides several recreational opportunities, including OHV use and hunting. However, a 290-MW solar facility is under construction on private land within the proposed SEZ, and this facility has the potential to alter a user's recreational experience in the area.

As shown in **Figure 5-1**, Existing and Proposed Renewable Energy, Transmission, and other Development there is one pending solar application within the proposed Agua Caliente SEZ and three pending solar applications on BLM-administered lands within an approximately 20-mile radius of the proposed SEZ. There are currently no wind or geothermal applications within this distance. The other foreseeable projects (identified in **Section 5.1.2**, Past, Present, and Reasonably Foreseeable Future Actions) on private and public land near the proposed Agua Caliente SEZ are most likely to be few in number and would have few additional impacts on recreation near the proposed Agua Caliente SEZ.

If continued solar energy development were to occur anywhere within the proposed Agua Caliente SEZ, current access routes could be modified, eliminated, or added to depending on the specifics of a proposal. As the area within and around the proposed SEZ is known to be a valued recreation area by local users, any renewable energy proposals would be considered with careful route planning to ensure continued recreational access to the area.

5.3.13 Socioeconomics

Impacts Common to All Alternatives

Past, present, and reasonably foreseeable future actions and conditions within the planning area that have affected and will likely continue to affect socioeconomics include factors that change the availability or type of jobs and industry in the planning area, alter the social composition of planning area communities, or otherwise change quality of life for area residents. Factors

include but are not limited to, mineral exploration and energy development (including renewable energy), road construction, and infrastructure development. In addition, population growth in Arizona has and will likely continue to increase residential and commercial development; which in turn increases the demand for energy, water, and other resources; and putting additional demands on public lands for recreational use.

As discussed in **Chapter 4,** Environmental Consequences potential socioeconomic impacts from renewable energy development include employment, wages, tax revenues, and property value change resulting from project construction and operation, as well as population change related to in-migration of workers and their families and the subsequent social and economic changes in communities. Impacts would vary by technology employed, but cumulative contributions to the planning area economy from renewable energy are likely to be negligible due to the short term nature of construction jobs and small number of permanent operations and maintenance employees required.

Based on the solar RFDS for the project (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona), development in the planning area can be expected to result in a generating capacity of 9,500 MW, including 1,500 MW on BLM-administered lands by 2025. Using the estimates provided above, the RFDS for the planning area may result in a low of 5,700 jobs to a high of 13,110 jobs for construction (average 9,405) and 475 to 4,465 jobs for operations and maintenance (average 1,853), while the projections for BLM-administered lands include a low of 900 jobs to a high of 2,070 jobs for construction (average 2,850) and 75 to 705 for operations and maintenance (average 293).

Based on the wind RFDS for the project (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona), development in the planning area can be expected to result in a generating capacity of 820 MW, including 130 MW on BLM-administered lands by 2025. Using the estimates provided above, the RFDS for the planning area may result in a low of 328 jobs to a high of 3,075 jobs for construction (average 1,083 jobs) and 41 to 164 for operations and maintenance (average 74 jobs), while the projections for BLM-administered lands include a low of 52 to a high of 487 jobs for construction (average 172 jobs) and 6.5 to 26 jobs for operations and maintenance (average 12 jobs).

Development projects, including renewable energy, could also contribute to a cumulative decrease in open space due to site infrastructure. Loss of open space could result in an overall loss of recreation opportunities, a degradation of visual resources, and an overall changing of the landscape as well as loss of lands for agriculture, livestock grazing, mineral uses, or other resource uses. Overall social perceptions and conceptualizations of certain landscapes, including regional and community identity, could shift (e.g., a community that is

historically known for mineral extraction or grazing could be thereafter thought of as a wind farm community). Approved solar energy development could cause disturbance on up to 5,684 acres, and an addition 457,903 acres of additional solar applications are pending. Wind energy has been developed on 12,918 acres throughout Arizona with pending wind applications totaling an additional 172,018 acres. Transmission line development would cause the disturbance of a corridor around lines and permanent removal of habitat in small areas associated with pole or tower structures. Total proposed transmission lines may disturb approximately 1,859,000 acres and existing transmission has disturbed an additional 1,900,000 acres. Overall, renewable energy development and associated infrastructure would have minor to negligible contributions to cumulative impacts due to the small number of acres impacted in relation to the acres of public lands available in the planning area.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which would contribute to cumulative impacts on socioeconomics and environmental justice if approved.

Impacts from Alternative 1 through 6

Impacts from REDAs

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Depending on the site of development, technology that would be developed, existing land uses and related economics, as well as the social structure of communities, socioeconomics could be impacted to varying degrees. Under Alternative 1, impacts on other land uses, recreation, and open space are likely to be negligible since much of the renewable energy development would take place on previously disturbed sites or on areas of low resource sensitivity.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 1 would cover 20,600 acres and would contribute to the changes in socioeconomics in Yuma and surrounding counties.

5.3.14 Soil Resources

Impacts Common to All Alternatives

Cumulative impacts on soil resources include ground disturbing actions which increase potential for erosion due to soil compaction, degradation of biological soil crusts, removal of topsoil, changes or loss of vegetative cover, or other factors. Changes in past, present, and reasonably foreseeable future actions and

conditions within the planning area that have affected and will likely continue to affect soil resources include but are not limited to mineral exploration and energy development, vegetation treatments, grazing, recreation including off-highway vehicle use, road construction, water diversion and withdrawals, wildland fires, commercial and urban development, and drought.

Solar development, particularly utility-scale development, requires the grading of large acreages resulting in soil disturbance and permanent changes to soil resources where development occurs. While the topography of suitable areas is necessarily flat, the entirety of areas where solar fields are built would have to be graded to produce a smooth, very flat surface for solar collectors. Such grading would render large areas susceptible to soil erosion. This would be particularly of concern in areas where biological soil crusts would be degraded due to construction activities. Approved solar energy development could cause up to 5,684 acres of habitat removal, and an addition 457,903 acres of additional solar applications are pending.

Most solar energy development has been proposed in the southwestern portion of the state within the Yuma, Lower Sonoran, and Lake Havasu Field Offices. Soils within this region are predominantly within the Aridisols soil order, have low organic content, and are susceptible to erosion, particularly from wind. While soil erosion mitigation measures including stipulations and permitting requirements for development would generally be required to minimize impacts on soil resources, some soil loss would be unavoidable with solar development, given the large acreages disturbed and typically dry soil conditions in the region.

In addition, wind energy has been developed on 12,918 acres throughout Arizona with pending wind applications totaling an additional 172,018 acres; while grading and soil disturbance are not required on the same scale as would be required for solar development, soils may be disturbed on a small percentage of this area. Similarly, transmission line development (1,859,000 acres and existing 1,900,000 acres proposed development) would cause potential compaction and of a corridor around lines and permanent alternation of soil conditions in small areas associated with pole or tower structures.

Climate change could cause an increase or decrease in temperatures and precipitation, which would affect soil conditions as well as vegetative cover and water flows, which could have secondary impacts on erosion.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which would contribute to cumulative impacts on soil resources if approved. Without a programmatic approach to solar and wind energy development or development of standard design features and BMPs, approval of such applications may increase impacts on soil resources.

Impacts from Alternative 1

Impacts from Maximum REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 1 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. Depending on the location and soil type and technology that would be developed, soil resources could be disturbed and potential for erosion increased to a varying degree.

The acres of land in the REDAs by soil order are shown in **Table 5-3**, Potential Soils Impacts in the Planning Area. It should be noted that acres below represent the REDA and actual contributions to cumulative impacts on soil disturbance would be based on location of on the ground development and are likely to be significantly less.

Table 5-3
Potential Soils Impacts in the Planning Area

Soil Order	Acres of REDA for lands of all ownership				
	Alternatives land 3	Alternative 2	Alternative 4	Alternative 5	Alterative 6
Alfisols	31,900	8,500	1,800	--	10,300
Aridisols	2,286,600	1,735,300	1,118,700	41,400	1,814,500
Entisols	213,100	99,300	87,800	1,800	131,100
Inceptisols	1,200	200	1,000	--	1,000
Mollisols	71,800	34,600	19,800	--	41,400
Vertisols	45,900	1,600	12,300	--	13,900
Miscellaneous	38,900	19,700	9,900	500	20,200

Source: NRCS 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 1 would cover 20,600 acres and would contribute to the increased potential for soil disturbance and erosion in the proposed SEZ.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 2 would contribute to cumulative impacts by making 218,600 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. Impacts from transmission line construction would be reduced under this alternative, since the REDA would be sited close to existing transmission lines and utility corridors.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 2 would cover 6,770 acres and would contribute to the potential for disturbance of soil resources within the planning area.

Impacts from Alternative 3

Impacts from Load Offset REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 3 would contribute to cumulative impacts by making 129,800 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,121,500 acres of non-BLM-administered lands that could be suitable for renewable energy development. Depending on the location and soil type and technology that would be developed, soil resources could be disturbed and potential for erosion increased to a varying degree.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 3 would cover 2,760 acres and would contribute to the potential for disturbance of soil resources within the planning area.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 4 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy

development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. Under this alternative, potential for soil subsidence would be reduced, as the REDA is sited to protect groundwater resources.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 4 would be similar to those described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 5 would contribute to cumulative impacts by making 43,700 acres of BLM-administered lands available for solar and wind energy development.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 6 would contribute to cumulative impacts by making 237,100 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,795,300 acres of non-BLM-administered lands that could be suitable for renewable energy development. Alternative 6 would reduce cumulative impacts on soil resources by combining the protective features of all the alternatives. This would reduce disturbance of soil and include measures to minimize erosion of soils.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 6 would be similar to those described for Alternative 2.

5.3.15 Special Designations

Impacts Common to All Alternatives
Lands suitable for solar energy development in the planning area, whether public or private, are typically basin flats or nearly flat areas surrounded by mountains. These lands are often located near one or more specially designated areas or lands with wilderness characteristics, which often lie in the surrounding mountains but also include protected desert areas. Potential effects of nearby renewable energy facilities on these sensitive areas include visual impacts, reduced access, impacts on wildlife that use the developed areas, and fugitive dust during construction, which may affect visibility (see the relevant sections for further discussion of these impacts).

Cumulative impacts on these sensitive areas would be from increased development, and visual clutter in the surrounding areas, reduced local and regional visibility due to construction-related air particulates, light pollution, road traffic, and impacts on wildlife and plants. Mining, off-road vehicle use, military and civilian aviation, new transmission lines and other linear facilities, urban development and renewable energy development are the major foreseeable contributors to cumulative impacts on special designations, with solar energy the primary contributor in many areas. Most such developments would affect the viewshed and would produce fugitive dust emissions during construction, while mining and aviation would also have noise and vibration effects. While all wind and solar technologies would produce visual effects, other impacts would depend on the employed technology, such as PV having generally the lowest overall impact as compared to other technologies such as solar towers or very large wind turbines. Because of the general vastness of the affected area and considering the foreseeable impacts on specially designated areas in the planning area under the RFDS, overall disturbance would be relatively minor, but could be more pronounced in areas near potential development. Several design features required under the action alternatives would minimize the impacts from renewable energy development, including (1) siting facilities as far as possible from key observation points (KOPs) and (2) limiting fugitive dust generation during construction through best management practices and proper timing of work.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which would contribute to adding to the visual clutter and atmospheric and aural intrusions which would be mitigated on a case-by-case basis without a suite of standard design features and BMPs.

Impacts from Alternatives 1 through 6

Impacts from REDAs and Proposed Agua Caliente Solar Energy Zone

The nature and types of impacts under each alternative would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred. The extent of cumulative impacts would be similar to those described for visual resources (**Section 5.3.18**, Visual Resources).

5.3.16 Special Status Species

Impacts Common to All Alternatives

Cumulative impacts on special status species would be similar to those described for vegetation (**Section 5.3.17**, Vegetation) and wildlife (**Section 5.3.6**, Fish and Wildlife). Loss of habitat is an important factor contributing to the increase in the number of species listed as threatened or endangered in recent years. Past, present, and reasonably foreseeable future actions and

conditions within the planning area that have affected and will likely continue to affect special status species include, but are not limited to, mineral exploration and energy development, forestry, grazing, recreation, road construction, water diversion and withdrawals, weed invasion and spread, prescribed and wildland fires, land use planning efforts, vegetation treatments, habitat improvement projects, insects and disease, and drought. Many of these activities change habitat conditions, which then cause or favor other habitat changes. For example, wildland fire removes habitat, and affected areas are then more susceptible to weed invasion, soil erosion, and sedimentation of waterways, all of which degrade habitats. In general, resource use activities have cumulatively caused habitat removal, fragmentation, noise, increased human presence, and weed spread, whereas land use planning efforts and vegetation, habitat, and weed treatments have countered these effects by improving habitat connectivity, productivity, diversity, and health.

Climate change could cause an increase or decrease in temperatures and precipitation, which would affect soil conditions, vegetative health, and water flows and temperature. Such changes would alter habitat conditions, potentially creating conditions that could favor certain species or communities, weeds, or pests. Since special status species often inhabit very specific microhabitats, small changes could cause large effects.

Stipulations and permitting requirements, including appropriate compliance with the Endangered Species Act, would minimize the risk of directly taking listed species, but there could be a cumulative effect from removal of small patches of habitat that can add up to a notable acreage, reducing available habitat for use by wildlife while potentially fragmenting suitable habitat and movement corridors. Activities on BLM lands would be required to protect BLM sensitive species, which would prevent the need to list these species.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which would contribute to cumulative impacts on special status species if approved. Without a programmatic approach to solar and wind energy development, approval of such applications may increase fragmentation of special status species' habitats.

Impacts from Alternative 1

Impacts from Maximum REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 1 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis

of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. Depending on the technology that would be developed, special status species' habitat could be removed or fragmented over large areas and over the long term.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 1 would cover 20,600 acres and would contribute to the loss of potential habitat for special status species within Arizona.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 2 would contribute to cumulative impacts by making 218,600 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,680,600 acres of non-BLM-administered lands that could be suitable for renewable energy development. Impacts from transmission line construction would be reduced under this alternative, since the REDA would be sited close to existing transmission lines and utility corridors.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 2 would cover 6,770 acres and would contribute to the loss of potential habitat for special status species within Arizona.

Impacts from Alternative 3

Impacts from Load Offset REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 3 would contribute to cumulative impacts by making 129,800 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,121,500 acres of non-BLM-administered lands that could be suitable for renewable energy development. Depending on the technology that would be developed, special status species habitat could be removed or fragmented over large areas and over the long term.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 3 would cover 2,760 acres and would contribute to the loss of potential habitat for special status species within Arizona.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 4 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. Adverse impacts on habitat conditions would be reduced under this alternative, as the REDA is sited to protect groundwater resources, having impacts as described in **Section 4.2.19**, Special Status Species.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 4 would be similar to those described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 5 would contribute to cumulative impacts by making 43,700 acres of BLM-administered lands available for solar and wind energy development.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 6 would contribute to cumulative impacts by making 237,100 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,795,300 acres of non-BLM-administered lands that could be suitable for renewable energy development. Alternative 6 would reduce cumulative impacts on special status species by combining the protective features of all the alternatives. This would reduce new habitat disturbance, removal, and fragmentation.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 6 would be similar to those described for Alternative 2.

5.3.17 Vegetation

Impacts Common to All Alternatives

Cumulative impacts from past, present, and reasonably foreseeable actions could have a variety of effects on vegetation. Vegetation management; solar, wind, and transmission line development; roads; and fires would remove vegetation over the short term and potentially the long term. Site-specific effects would depend on the affected vegetation community, revegetation efforts, if any, and extent of disturbance. Approved solar energy development could cause up to 5,684 acres of vegetation removal, and an addition 457,903 acres of additional solar applications are pending. Most solar energy development has been proposed in the southwestern portion of the state within the Yuma, Lower Sonoran, and Lake Havasu Field Offices. It is likely that lower and upper Sonoran desert scrub would be the most affected vegetation communities within this area. Wind energy has been developed on 12,918 acres throughout Arizona; a small portion of that acreage has been cleared of vegetation over the long term. Pending wind applications total 172,018 acres. Transmission line development would cause the removal of small areas of vegetation associated with pole or tower structures. The total amount of vegetation removed would depend on the number of these structures.

All ground disturbing activities would increase the likelihood of invasive or noxious weeds becoming introduced or spread into an area. All permitted activities would require weed control and prevention measures to reduce this impact.

Vegetation community composition could be influenced or changed by vegetation management and forestry actions, grazing, recreation, groundwater withdrawals for domestic or irrigation use, drought, and climate change. Certain species could be favored, or invasive species could become dominant. Such changes in vegetation could alter habitat suitability for wildlife or special status species.

Some BLM activities would have the potential to improve or preserve existing vegetation communities. Vegetation management and weed treatments would be implemented on a site-specific basis to achieve desired vegetation community composition and remove invasive and noxious weeds. Land tenure adjustments and consolidation of BLM lands would ideally improve the effectiveness and efficiency of BLM land management, including vegetation management. Establishment of energy corridors would concentrate development and vegetation removal in certain areas, thereby preventing the widespread fragmentation and removal of vegetation for transmission line projects.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Under the

No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which would contribute to cumulative impacts on vegetation if approved. Without a programmatic approach to solar and wind energy development, approval of such applications may increase fragmentation of vegetation communities.

Impacts from Alternative 1

Impacts from Maximum REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 1 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development (see **Table 5-4**, Potential Vegetation Impacts in the REDA for Alternative 1). Depending on the technology that would be developed, vegetation could be removed over large areas and over the long term.

Table 5-4
Potential Vegetation Impacts in the REDA for Alternative 1

Vegetation Community	All Lands within REDA
Arizona/New Mexico Mountains	202,600
Arizona/New Mexico Plateau	882,000
Chicuahuan Desert	2,900
Madrean Archipelago	16,400
Mojave Basin and Range	294,600
Sonoran Desert	1,265,400
Colorado Plateaus	25,400

Source: BLM 2011a, EPA 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 1 would cover 20,600 acres and would contribute to the loss of lower Sonoran desert scrub within Arizona.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 2 would contribute to cumulative impacts by making 218,600 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis

of low resource sensitive areas found approximately 1,680,600 acres of non-BLM-administered lands that could be suitable for renewable energy development (see **Table 5-5**, Potential Vegetation Impacts in the REDA for Alternative 2). Impacts from transmission line construction would be reduced under this alternative, since the REDA would be sited close to existing transmission lines and utility corridors.

Table 5-5
Potential Vegetation Impacts in the REDA for Alternative 2

Vegetation Community	All Lands within REDA
Arizona/New Mexico Mountains	85,900
Arizona/New Mexico Plateau	341,700
Chicuahuan Desert	2,900
Madrean Archipelago	10,100
Mojave Basin and Range	280,300
Sonoran Desert	1,159,600
Colorado Plateaus	18,700

Source: BLM 2011a, EPA 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 2 would cover 6,770 acres and would contribute to the loss of lower Sonoran desert scrub within Arizona.

Impacts from Alternative 3

Impacts from Load Offset REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 3 would contribute to cumulative impacts by making 129,800 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,121,500 acres of non-BLM-administered lands that could be suitable for renewable energy development (see **Table 5-6**, Potential Vegetation Impacts in the REDA for Alternative 3). Depending on the technology that would be developed, vegetation could be removed over large areas and over the long term.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 3 would cover 2,760 acres and would contribute to the loss of lower Sonoran desert scrub within Arizona.

Table 5-6
Potential Vegetation Impacts in the REDA for Alternative 3

Vegetation Community	All Lands within REDA
Arizona/New Mexico Mountains	60,300
Arizona/New Mexico Plateau	184,500
Chicuahuan Desert	2,900
Madrean Archipelago	9,900
Mojave Basin and Range	82,500
Sonoran Desert	894,700
Colorado Plateaus	16,400

Source: BLM 2011a, EPA 2011a

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives, above. Alternative 4 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development (see **Table 5-7**, Potential Vegetation Impacts in the REDA for Alternative 4). Impacts such as changes in vegetation community composition would be reduced under this alternative, as the REDA is sited to protect groundwater resources, having impacts as described in **Section 4.2.21**, Vegetation.

Table 5-7
Potential Vegetation Impacts in the REDA for Alternative 4

Vegetation Community	All Lands within REDA
Arizona/New Mexico Mountains	202,600
Arizona/New Mexico Plateau	882,000
Chicuahuan Desert	2,900
Madrean Archipelago	16,400
Mojave Basin and Range	294,600
Sonoran Desert	1,265,400
Colorado Plateaus	25,400

Source: BLM 2011a, EPA 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 4 would be similar to those described for Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 5 would contribute to cumulative impacts by making 43,700 acres of BLM-administered lands available for solar and wind energy development on.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 6 would contribute to cumulative impacts by making 237,100 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,795,300 acres of non-BLM-administered lands that could be suitable for renewable energy development (see **Table 5-8**, Potential Vegetation Impacts in the REDA for Alternative 6). Alternative 6 would reduce cumulative impacts on vegetation by combining the protective features of all the alternatives. This would reduce new vegetation disturbance and removal.

Table 5-8
Potential Vegetation Impacts in the REDA for Alternative 6

Vegetation Community	All Lands within REDA
Arizona/New Mexico Mountains	116,400
Arizona/New Mexico Plateau	413,300
Chicuahuan Desert	2,900
Madrean Archipelago	11,700
Mojave Basin and Range	280,800
Sonoran Desert	1,185,100
Colorado Plateaus	22,000

Source: BLM 2011a, EPA 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 6 would be similar to those described for Alternative 2.

5.3.18 Visual Resources

Impacts Common to All Alternatives

Impacts from REDAs

Projects described in **Table 5-1**, Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions that make up the past, present, and reasonably foreseeable actions that collectively define the cumulative impact scenario. This scenario involves components, including facilities, new roads, transmission lines, pipelines, and canals, that have or could diminish the visual quality and sensitivity of the landscape and could be significant given the infrastructure required to support urbanization and growing population in Arizona and the West. Impacts on visual resources can compound as the landscape is modified making the cumulative result greater than the additive impact of each new modification. As noted in **Section 4.2.22**, Visual Resources, because of the experiential nature of visual resources, the human response to visual changes in the landscape cannot be quantified and the perceived impact varies by viewer and by project type.

The RDEP project, when compared to the cumulative impact scenario is not expected to contribute a significant impact to visual resources considering that, per the RFDS (**Appendix A**, Resource Potential and Reasonably Foreseeable Development Scenario Report) a total of 15,600 acres of BLM-administered land is projected to be utilized for solar and wind energy development by 2025, which is less than 1 percent of both BLM-administered land in Arizona and all land in Arizona. It should be noted that the estimated 15,600 acres of disturbance is only for the installations themselves and does not account for new transmission lines, roads, or other facilities that might be needed in association with the solar or wind facility.

Impacts from the Proposed Agua Caliente Solar Energy Zone

There is one solar facility adjacent to the proposed Agua Caliente SEZ on private land, First Solar's Agua Caliente Solar Project. There is one pending solar application within the proposed SEZ and three pending solar applications on BLM-administered lands within an approximately 20-mile radius of the proposed SEZ; all are proposing CSP trough facilities ranging in size from 325MW to 600MW of generation.

While the contribution to cumulative impacts in the area of potential projects would depend on the locations of facilities that are actually built, it may be concluded that the general visual character of the landscape within the region would continue to be significantly altered by the presence of solar facilities, transmission lines, and other new infrastructure. Currently, the VRI for the area within the proposed SEZ is Class III; with continued development, it is possible that a new VRI would result in changes to the classification, such as lowering it to a VRI Class IV. Outside the proposed SEZ, to the north and west, the VRI is a Class II; again, considering the reasonably foreseeable actions in the area of

the proposed SEZ, it is possible that should a new VRI be undertaken, it may also change in the area immediately adjacent to the proposed SEZ to a lower class, such as Class III or Class IV. Additionally, developments would be visible from surrounding mountains and highlands, which include sensitive viewsheds (e.g., Sears Point ACEC and Eagletail Mountains, Signal Mountain, and Woolsey Peak Wilderness Areas). Given the proximity of the pending solar applications to the proposed SEZ and to each other, it is possible that two or more solar facilities would be viewable from a single location. However, the pending projects would be away from major roadways and would be visible mostly by local traffic.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which would contribute to cumulative impacts on vegetation if approved. Without a programmatic approach to solar and wind energy development, approval of such applications may increase fragmentation of vegetation communities.

Impacts from Alternatives 1 through 6

Impacts from REDAs and Proposed Agua Caliente Solar Energy Zone

The type and nature of impacts under each alternative would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred or the size of the REDA or proposed SEZ.

5.3.19 Water Resources

Impacts Common to All Alternatives

Cumulative impacts from past, present, and reasonably foreseeable actions could have a variety of effects on water resources, as described in **Section 4.3.23**, Water Resources. Water Resource management; solar, wind, and transmission line development; and roads would result in land surface disturbance over the short term and potentially the long term. Site-specific effects would depend on the extent of disturbance. Approved solar energy development could result in up to 5,684 acres of surface disturbance, and an addition 457,903 acres of additional solar applications are pending. Most solar energy development has been proposed in the southwestern portion of the state within the Yuma, Lower Sonoran, and Lake Havasu Field Offices.

Wind energy has been developed on 12,918 acres throughout Arizona; a small portion of that acreage would result in land surface disturbance over the long term. Pending wind applications total 172,018 acres. Transmission line development would cause land disturbance in small areas associated with pole or tower structures. The total amount of land disturbance would depend on the number of these structures.

Ground disturbing activities associated with construction and operations would increase the likelihood of water use and potential for reductions in water quality and quantity. All permitted activities would require sedimentation and erosion control measures to reduce this impact. Surface water and groundwater could be influenced or changed by water diversions, grading activities, groundwater withdrawals for domestic or irrigation use, drought, and climate change.

Some BLM activities would have the potential to improve or preserve existing vegetation communities. Vegetation management and weed treatments would be implemented on a site-specific basis to achieve desired vegetation community composition and remove invasive and noxious weeds. Land tenure adjustments and consolidation of BLM lands would improve the effectiveness and efficiency of BLM land management, including the protection of water quality and quantity. The use of energy corridors would concentrate development and groundwater withdrawals in certain areas, thereby minimizing impacts on water resources associated with transmission line projects.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which would contribute to cumulative impacts on water resources if approved. Without a programmatic approach to solar and wind energy development, approval of such applications may increase groundwater level drawdown.

Impacts from Alternative 1

Impacts from Maximum REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 1 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. Depending on the technology that would be developed, water resources could be impacted over large areas and over the long term. There is potential for energy facilities to concentrate in areas with abundant solar and wind energy resources, which could contribute to cumulative depletion of water resources.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 1 would cover 20,600 acres and

would contribute to cumulative impacts on groundwater if the added use of groundwater demand is nearing the available groundwater supply.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 2 would contribute to cumulative impacts by making 218,600 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,680,600 acres of non-BLM-administered lands that could be suitable for renewable energy development. Impacts from transmission line construction would be reduced under this alternative, since the REDA would be sited close to existing transmission lines and utility corridors.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 2 would cover 6,770 acres and would contribute to cumulative impacts on groundwater if any new use of groundwater affected the sustainability of groundwater supply in the local basin.

Impacts from Alternative 3

Impacts from Load Offset REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 3 would contribute to cumulative impacts by making 129,800 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,121,500 acres of non-BLM-administered lands that could be suitable for renewable energy development. Depending on the technology that would be developed, cumulative impacts on groundwater resources could be reduced over the long-term by using the design features identified in **Section 2.3.2**, Elements Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ under Alternative 3 would cover 2,760 acres and would contribute to cumulative impacts on groundwater if the added use of groundwater demand is nearing the available groundwater supply.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 4 would contribute to cumulative impacts by making 321,500 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 2,367,900 acres of non-BLM-administered lands that could be suitable for renewable energy development. Impacts such as changes in groundwater would be reduced under this alternative, as the REDA is sited to protect groundwater resources and would avoid or reduce long term cumulative impacts on groundwater resources by siting projects in areas with lower groundwater vulnerability levels.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 4 would be similar to those described for Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 5 would contribute to cumulative impacts by making 43,700 acres of BLM-administered lands available for solar and wind energy development.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Alternative 6 would contribute to cumulative impacts by making 237,100 acres of BLM-administered land available and a priority for solar and wind energy development. Looking beyond the BLM-administered lands, GIS spatial analysis of low resource sensitive areas found approximately 1,795,300 acres of non-BLM-administered lands that could be suitable for renewable energy development. Alternative 6 would reduce cumulative impacts on water resources by combining the protective features of all the alternatives. This alternative would reduce land disturbance and water consumption.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from the proposed Agua Caliente SEZ under Alternative 6 would be similar to those described for Alternative 2.

5.3.20 Wild Horses and Burros

Impacts Common to All Alternatives

Cumulative impacts on wild horse and burros are those that would directly disturb wild horses and burros or affect available forage, water, habitat or

movement corridors. Past, present and reasonably foreseeable future actions and conditions within the planning area that have affected and will likely continue to affect wild horse and burros include changes in forage or water or availability of acres of grazing lands due to action such as vegetation treatments, land disposal, wildfire, drought, and urban and commercial development.

Impacts on wild horse and burros from renewable energy development would be dependent upon the site specific location of development in relation to heard management areas (HMAs). Facilities would generally not be sited directly within HMAs. Wild horse and burro HMAs could be affected by renewable energy facilities if management areas are located adjacent to areas of development, nominally within 5 miles (8 kilometers) of the facilities. Impacts from renewable energy development include disturbance of horse and burros, disruption of movement corridors, changes in vegetation forage, or access to water sources.

In addition, climate change could cause an increase or decrease in temperatures and precipitation, which would affect soil conditions, vegetative health, and water flows and temperature. Such changes would alter potentially alter forage available for wild horse and burros and the number of animals that HMAs may support on a sustainable basis, therefore the appropriate management level for HMAs would need to be adjusted should significant changes in climate occur.

Impacts from the No Action Alternative

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impact Common to All Alternatives. Under the No Action Alternative, solar and wind energy development applications would be processed on a case-by-case basis, which could contribute to cumulative impacts on wild horse and burros if approved.

Impacts from Alternative 1

Impacts from Maximum REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. Depending on the location of development in relation to HMAs and the technology that would be developed, water available for wild horses or burros could be impacted. A total of 234,200 acres of HMAs are located within five miles of the REDA. No development would occur directly on HMAs, and design features require measures that may protect horse and burros such as traffic management, and fencing. As a result, contributions to cumulative impacts would be negligible.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from past, present, and reasonably foreseeable actions would be as described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ is not located within or adjacent to a HMA, therefore contributions to cumulative impacts would be negligible.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be similar to those described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from the proposed Agua Caliente SEZ would be similar to those described for Alternative 1.

Impacts from Alternative 3

Impacts from Load Offset REDA

Cumulative impacts from the proposed Agua Caliente SEZ would be similar to those described for Alternative 1. A total of 96,600 acres of HMAs are located within five miles of the REDA. As this alternative focuses on utility-scale, community, or dispersed development projects near load centers, this would likely be farther away from the HMAs and result in fewer cumulative impacts when combined with other reasonably foreseeable future actions.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from the proposed Agua Caliente SEZ would be similar to those described for Alternative 1.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Cumulative impacts from past, present, and reasonably foreseeable actions would be similar to those described under Alternative 1. Impacts on water availability would be reduced under this alternative, as the alternative proposes additional water design features anticipated to protect vulnerable groundwater resources.

Impacts from Proposed Agua Caliente Solar Energy Zone

Cumulative impacts from the proposed Agua Caliente SEZ would be similar to those described for Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Cumulative impacts from the proposed Agua Caliente SEZ would be similar to those described for Alternative 1. A total of 8,300 acres of HMAs are located within five miles of the REDA.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Cumulative impacts from the proposed Agua Caliente SEZ would be similar to those described for Alternative 1. A total of 265,500 acres of HMAs are located within five miles of the REDA. Alternative 6 would reduce cumulative impacts on disturbance and water availability by combining the protective features of all the alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Cumulative impacts from the proposed Agua Caliente SEZ would be similar to those described for Alternative 1.

5.3.21 Wilderness Characteristics

Impacts Common to All Alternatives
As discussed in **Section 4.2.25**, Wilderness Characteristics the proposed project will indirectly impact lands with wilderness characteristics as well as reduce the number of areas currently managed to maintain wilderness characteristics. Current trends in vegetation management, recreation and visitor use, roadway development, wildland fires and climate change are likely to impact lands with wilderness characteristics in a similar manner (See **Table 5-1**, Past, Present and Reasonably Foreseeable Projects, Plans, or Actions).

In the past ten years Arizona's population has grown significantly and is expected to continue to grow in the future. Along with a larger population may come an increase in commercial and personal forestry, participation in outdoor recreation and an increase in the construction of roads. Areas with wilderness characteristics are likely to be utilized for outdoor recreation. This would impact areas with wilderness characteristics as an increase in evidence of human presence would decrease the experience of solitude and naturalness.

Roadway development throughout Arizona is expected to continue at the current rate, likely resulting in increased noise and light pollution, and evidence of human activity thereby influencing visitor experience of wilderness characteristics.

An increase in wildland fires due to climate change is also expected. While wildland fires would not lessen the solitude or naturalness of an area with wilderness characteristics, it would impact visitors' ability to access the area for primitive and unconfined recreation.

The cumulative impacts of these current trends and the impacts of solar and wind development could diminish the naturalness of the area and the opportunities for solitude and primitive or unconfined recreation to the degree they may cease to exist in the area, resulting in a reduction of the total acres of lands with wilderness characteristics.

The cumulative impacts of the above trends and the proposed project are likely to affect the size and number of areas with wilderness characteristics, both managed and unmanaged. Though solar and wind development would not be constructed on areas with wilderness characteristics, the cumulative indirect impacts of any solar or wind development could affect these areas to the point that they no longer provide experiences of wilderness. While these trends all have the potential to have significant impacts on areas with wilderness characteristics, the actual impacts on lands with wilderness characteristics will

depend on the proximity of the actions to these areas and the extent of the disturbance and development.

Impacts from the No Action Alternative

If no action occurs, the current trends discussed above will continue to pose a threat to areas with wilderness characteristics. Other planning projects will continue according to BLM discretion. However, since the BLM has no comprehensive approach to solar and wind energy development, other projects could impact lands with wilderness characteristics through proximity or by fragmenting Arizona's landscape.

Impacts from Alternative 1

Impacts from Maximum REDA

Cumulative impacts from the past, present, and reasonably foreseeable actions are described under Impacts Common to All Alternatives. Under Alternative 1, 65,200 acres of lands with wilderness characteristics managed to protect their characteristics are within five miles of the proposed REDA, making them more likely to be impacted by solar or wind development and consequently more sensitive to cumulative impacts. Similarly, 439,300 acres of lands with wilderness characteristics not managed to protect their characteristics are within five miles of the proposed REDA, making these areas particularly vulnerable to cumulative impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 1, 9,450 acres of land with wilderness characteristics managed and not managed to maintain wilderness characteristics would be within the proposed Agua Caliente SEZ. These acres of land with wilderness characteristics will be particularly vulnerable to cumulative impacts. Cumulative impacts from past, present and reasonably foreseeable actions are described under Impacts Common to All Alternatives.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Cumulative impacts from the past, present, and reasonably foreseeable actions are described under Impacts Common to All Alternatives. Under Alternative 2, 58,400 acres of lands with wilderness characteristics managed to protect their characteristics are within five miles of the proposed REDA, making them more likely to be impacted by solar and wind development and consequently more sensitive to cumulative impacts. Similarly, 375,800 acres of lands with wilderness characteristics not managed to protect their characteristics are within five miles of the proposed REDA, making these areas also particularly vulnerable to cumulative impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 2, 1,700 acres of land with wilderness characteristics not managed to maintain wilderness characteristics would be within the proposed Agua Caliente SEZ. These acres of land with wilderness characteristics will be

particularly vulnerable to cumulative impacts. Cumulative impacts from past, present and reasonably foreseeable actions are described under Impacts Common to All Alternatives.

Impacts from Alternative 3

Impacts from Load Offset REDA

Cumulative impacts from the past, present, and reasonably foreseeable actions are described under Impacts Common to All Alternatives. Under Alternative 3, 65,200 acres of lands with wilderness characteristics managed to protect their characteristics are within five miles of the proposed REDA, making them more likely to be impacted by solar or wind development and consequently more sensitive to cumulative impacts. Similarly, 439,300 acres of lands with wilderness characteristics not managed to protect their characteristics are within five miles of the proposed REDA, making these areas particularly vulnerable to cumulative impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 3, 370 acres of land with wilderness characteristics not managed to maintain wilderness characteristics would be within the proposed Agua Caliente SEZ. These acres of land with wilderness characteristics will be particularly vulnerable to cumulative impacts. Cumulative impacts from past, present, and reasonably foreseeable actions are described under Impacts Common to All Alternatives.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Cumulative impacts from the past and present, and reasonably foreseeable actions are described under Impacts Common to All Alternatives. Under Alternative 4, 53,900 acres of lands with wilderness characteristics managed to protect their characteristics are within five miles of the proposed REDA, making them more likely to be impacted by solar or wind development and consequently more sensitive to cumulative impacts. Similarly, 298,800 acres of lands with wilderness characteristics not managed to protect their characteristics are within five miles of the proposed REDA, making these areas particularly vulnerable to cumulative impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone

The Proposed Agua Caliente SEZ analysis area is the same as described in Alternative 1. As such, impacts would be the same as those described under Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Cumulative impacts from the past, present, and reasonably foreseeable actions are described under Impacts Common to All Alternatives. Under Alternative 5, 1,100 acres of lands with wilderness characteristics managed to protect their characteristics are within five miles of the proposed REDA, making them more

likely to be impacted by solar and wind development and consequently more sensitive to cumulative impacts. Similarly, 4,500 acres of lands with wilderness characteristics not managed to protect their characteristics are within five miles of the proposed REDA, making these areas particularly vulnerable to cumulative impacts.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Cumulative impacts from the past, present, and reasonably foreseeable actions are described under Impacts Common to All Alternatives. Under Alternative 6, 58,400 acres of lands with wilderness characteristics managed to protect their characteristics are within five miles of the proposed REDA, making them more likely to be impacted by solar and wind development and consequently more sensitive to cumulative impacts. Similarly, 393,100 acres of lands with wilderness characteristics not managed to protect their characteristics are within five miles of the proposed REDA, making these areas particularly vulnerable to cumulative impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone

The Proposed Agua Caliente SEZ analysis area is the same as described in Alternative 2. As such, impacts would be the same as those described under Alternative 2.

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CHAPTER 6
CONSULTATION AND COORDINATION

6.1 PUBLIC SCOPING

The BLM Arizona sponsored a public scoping period to support preparation of the RDEP EIS. During the scoping period, BLM solicited comments on the development of the RDEP, including its overall scope and issues and concerns regarding solar energy development in Arizona, and to nominate previously disturbed sites to be considered for renewable energy development.

6.1.1 EIS Scoping

The formal public scoping process for the EIS began on January 13, 2010, when the BLM Arizona State Office published the Notice of Intent in the *Federal Register* on January 13, 2010. The RDEP EIS scoping period ran from January 13, 2010, to March 11, 2010. The Notice of Intent notified the public of the BLM's intent to prepare an EIS, provided information on the proposed action, announced the dates for the public scoping period, and included a list of BLM-identified preliminary issues.

The preliminary issues identified in the Notice of Intent included:

- Suitability of the site or area for renewable energy generation and scale of possible generation;
- Proximity of the site or area to the existing electrical transmission grid and the feasibility of integrating new electric generation projects with the grid;
- Proximity of the site or area to population and electric use (load) centers;
- Determining the appropriate renewable energy generation technologies for implementation site-by-site or area-by-area;

- The possible need for environmental remediation of RDEP sites or areas based on previous uses and levels of disturbance and possible contamination of the sites or areas; and
- Addressing the possible need for remediation, and incorporating remediation into design criteria that that might apply to site- or area-specific projects.

In addition to the Notice of Intent, the BLM notified the public of the RDEP and associated scoping period through media outlets, postcards, emails, and the RDEP Web site.

The BLM hosted 10 scoping meetings between February 8, 2010, and February 25, 2010. The scoping meetings gave the public an opportunity to learn and ask questions about the RDEP, to submit their site proposals, and to share issues and concerns with the BLM. The BLM chose an open-house meeting format to encourage broader participation, to allow attendees to learn about the RDEP at their own pace, and to enable attendees to ask BLM representatives questions in an informal one-on-one setting. In addition, the BLM provided a 25-minute presentation at each meeting about the RDEP and the public's role in the scoping process. **Table 6-1**, RDEP Scoping Meetings, lists the scoping meeting dates, locations, and the number of people who attended each meeting.

Table 6-1
RDEP Scoping Meetings

Date	Location	Number of Attendees
Monday, February 8, 2010	Phoenix, Arizona, BLM Arizona State Office	39
Tuesday, February 9, 2010	Tucson, Arizona, The Hotel Arizona	41
Wednesday, February 10, 2010	Sierra Vista, Arizona, Buena High School	4
Thursday, February 11, 2010	Phoenix, Arizona, Arizona Game and Fish Department	7
Wednesday, February 17, 2010	Fredonia, Arizona, Fredonia High School	2
Monday, February 22, 2010	Snowflake, Arizona, Pioneer Junior College	9
Tuesday, February 23, 2010	Flagstaff, Arizona, Coconino High School	8
Wednesday, February 24, 2010	Kingman, Arizona, La Senita Elementary School	26
Thursday, February 25, 2010	Yuma, Arizona BLM Arizona Yuma Field Office	8

Comments received during the initial scoping period largely fell into several key categories: environmental, socioeconomic, siting and technology, stakeholder involvement, cumulative impact analyses, impact mitigation, policy, land use planning, alternatives to be analyzed, and coordination with ongoing regional and state planning efforts (see list in **Section 1.10**, Key Planning Issues). The

scoping summary report and copies of all written comments submitted by mail, email, or in person at public meetings are available from the BLM Arizona State Office and on the RDEP Web site; transcripts from the public meetings are also available.

6.1.2 Disturbed Site Nomination Scoping

To facilitate the site nomination process, the BLM launched a Web site that provided RDEP details, a list of nominated sites, and a site submittal form (see RDEP Web site for complete scoping report, forms, and scoping materials at http://www.blm.gov/az/st/en/prog/energy/arra_solar/scoping.html). Before the BLM Arizona State Office published the project Notice of Intent in the *Federal Register*, local, state, and federal agencies, private companies, and members of the public nominated 42 potential sites. Throughout the scoping period, the BLM continued to receive nominations for consideration through the Web site, individual letters, and scoping meetings from local governments, businesses, and members of the public, resulting in 22 additional nominated sites for a total of 64 sites to date. **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites, summarizes all nominated sites. The appendix is an analysis and evaluation of the feasibility of the 64 suitable previously utilized sites in Arizona as sites for solar and wind energy generating stations. The appendix provides background information for the nominated sites, including solar and wind energy potential, environmental characteristics, and potential remediation or restoration requirements, and assesses the potential for solar and wind energy development on the nominated sites. The assessment used a site-screening process to evaluate the nominated sites; factors used in the evaluation included the area of developable land, solar and wind resource availability, maximum MW output, access to transmission lines and roads, water restrictions, and sensitive resource characteristics.

6.2 GOVERNMENT-TO-GOVERNMENT CONSULTATION

The federal government works on a government-to-government basis with Native American tribes. The government-to-government relationship was formally recognized on November 6, 2000, with Executive Order 13175 (*Federal Register*, Volume 65, page 67249). As a matter of practice, the BLM coordinates with all tribal governments, associated native communities, native organizations, and tribal individuals whose interests might be directly and substantially affected by activities on public lands. In addition, Section 106 of the NHPA requires federal agencies to consult with Indian tribes for undertakings on tribal lands and for historic properties of significance to the tribes that may be affected by an undertaking (36 CFR 800.2(c)(2)). BLM Manual 8120 (BLM 2004a) and BLM Handbook H-8120-1 (BLM 2004b) provide guidance for Native American consultations. The BLM has given substantial consideration to the proper conduct of government-to-government consultations for this project in order to provide for multiple opportunities for tribal consultation and has provided tribes with multiple ongoing opportunities to comment and receive information on and participate in the RDEP.

Executive Order 13175 stipulates that tribes identified as "directly and substantially affected" be consulted by federal agencies during the NEPA process. The BLM initiated contact with the following 23 tribal governments early in the EIS process:

- Ak-Chin Indian Community
- Fort Yuma-Quechan Tribe
- Pascua Yaqui Tribe
- Colorado River Indian Tribes
- Cocopah Tribe
- Yavapai-Prescott Indian Tribe
- Hualapai Tribe
- Hopi Tribe
- White Mountain Apache Tribe
- Havasupai Tribe
- San Carlos Apache Tribe
- Tonto Apache Tribe
- Navajo Nation
- Yavapai-Apache Nation
- Chemehuevi Tribe
- Kaibab Paiute Tribe
- Fort Mojave Tribe
- Pueblo of Zuni
- Gila River Indian Community
- Salt River Pima-Maricopa Indian Community
- Tohono O'odham Nation
- Fort McDowell Yavapai Nation
- San Juan Southern Paiute Tribe

Before and during the EIS public scoping phase, the BLM presented information on the RDEP to tribal officials and representatives in meetings at tribal offices at the Fort McDowell Yavapai Nation, Gila River Indian Community, Salt River Pima-Maricopa Indian Community, Ak-Chin Indian Community, Kaibab Paiute Tribe, Hualapai Tribe, and Hopi Tribe.

In May and June 2010, the BLM sent formal letters to the tribes inviting them to serve as cooperating agencies for the EIS and initiating formal consultation in

accordance with the NHPA and other legal authorities. Although no tribes requested formal status as cooperating agencies, several tribal governments responded with comments or requests for additional information or meetings.

In March 2011, letters were sent to the tribes providing an update on the progress of the EIS effort and the preliminary alternatives. BLM responded to letters and email correspondence received from several interested tribes. On April 15, 2011, the BLM Arizona State Director presented information and discussed the RDEP with elected tribal leaders at a meeting of the Inter Tribal Council of Arizona in Phoenix. Handouts were distributed to provide information on the project with preliminary maps of alternatives.

In August 2011, BLM sent letters to nine tribal governments to inform them that the newly proposed Agua Caliente SEZ would be analyzed in this EIS. Associated consultations are ongoing.

In addition to presentations at the Inter Tribal Council and follow-up contacts with tribal governments and staff via letters, email, and telephone, BLM managers and staff participated in face-to-face meetings with officials or representatives of the Gila River Indian Community, Salt River Pima-Maricopa Indian Community, Ak-Chin Indian Community, Tohono O'odham Nation, Hopi Tribe, Kaibab Paiute Tribe, Pueblo of Zuni, Hualapai Tribe, Fort Yuma-Quechan Tribe, Cocopah Tribe, San Carlos Apache Tribe, and White Mountain Apache Tribe.

During these meetings, the tribes identified their interests and concerns in regard to developing renewable energy projects on tribal lands, and highlighted a need by some tribal officials to better understand the nature, benefits, costs, and environmental impacts of various technologies. Tribes are concerned about the potential adverse effects of renewable energy development on tribal lands, adjacent lands, traditional territories, archaeological sites, and places of traditional cultural and religious importance. They are also concerned about potential impacts on springs and other water sources, and on animal and plant species of cultural significance. Some tribal representatives expressed concern about the visual impacts of solar tower and wind technologies.

Government-to-government consultation for the RDEP is ongoing via phone calls and emails. The BLM will continue to consult with interested tribes and will continue to keep all tribal entities informed about the NEPA process for the EIS. In addition, the BLM will continue to implement government-to-government consultation on a case-by-case basis for site-specific renewable energy development projects on BLM-administered lands.

6.3 COORDINATION WITH BLM WASHINGTON OFFICE AND ARIZONA FIELD OFFICES

Regular conference calls and other communications have been held with the BLM Washington Office, Division of Renewable Energy (the lead BLM office for preparing the Solar PEIS) to share information and coordinate developments

between the two initiatives. The BLM Arizona State Office and the field offices provided much of the GIS data that allowed mapping of the BLM-administered lands and special areas. Arizona state and field office staff were involved in reviews of preliminary internal draft sections of text.

Coordination with the state and field office staff will continue throughout the preparation of the Final EIS and ROD to ensure that the analysis adequately reflects state- and local-level concerns and issues regarding renewable energy development.

6.4 AGENCY COOPERATION, CONSULTATION, AND COORDINATION

The BLM invited federal, state, and local government agencies to participate in preparation of the RDEP as cooperating agencies. To date, eight agencies are working with the BLM as cooperating agencies, including:

- Arizona Department of Water Resources
- Arizona Game and Fish Department
- Arizona State Land Department
- Arizona Corporation Commission
- Arizona Department of Environmental Quality
- Central Arizona Water Conservation District
- US Bureau of Reclamation
- Western Area Power Administration

Interactions with the cooperating agencies have included periodic briefings and reviews of preliminary, internal draft sections of text. The BLM will continue to engage these cooperating agencies throughout the preparation of the EIS.

Additional federal agencies the BLM Arizona has coordinated with include the following:

- Department of the Interior:
 - Bureau of Indian Affairs
 - US Fish and Wildlife Service
 - National Park Service
- Department of Defense:
 - Military installations in Arizona
- US Forest Service

In accordance with the requirements of Section 106 of the NHPA, the BLM is coordinating with and soliciting input from the Arizona SHPO. The BLM and

Arizona SHPO are following the coordination protocols in the Arizona Protocol relating to amending resource management plans; the protocol provides for a phased consultation process related to historic, traditional, and cultural resources for an EIS and subsequent activities that could tier from a ROD. Per these procedures, the BLM Arizona initiated consultation with the Arizona SHPO by written correspondence on April 16, 2010. The letter introduced the RDEP and specified the need to consult on information regarding the amendment of land use plans. Also enclosed with the letter were two copies of the EIS scoping report for their review. The SHPO formally responded to the letter on May 27, 2010, expressing interest and support but no specific concerns. As the preliminary alternatives were identified, an additional letter was sent to SHPO on March 23, 2011, providing them with the new information. The SHPO responded to the preliminary alternatives letter by requesting additional information on the preliminary alternatives.

In accordance with the requirements of Section 7 of the Endangered Species Act, the BLM has consulted with the US Fish and Wildlife Service to ensure that the BLM's proposed action would not jeopardize the continued existence of any listed threatened or endangered species. These consultations are ongoing and will result in a biological assessment and biological opinion for the RDEP.

In addition, the BLM has coordinated and consulted with the Arizona governor and governor's office and other state agencies. Additional coordination will be conducted during review of the Draft EIS. Prior to approval of the proposed plan amendments, the governor will be given the opportunity to identify any inconsistencies between the proposed plan amendments and state or local plans and to provide recommendations in writing (during the 60-day consistency review period).

6.5 STAKEHOLDER OUTREACH AND COORDINATION

The BLM has met with numerous stakeholder groups to discuss their thoughts and ideas, and to identify any additional opportunities for or constraints on the project. The groups included:

- Arizona BLM RAC
- Arizona congressional staff
- State agencies:
 - Governor's Office
 - Arizona State University
 - Arizona Department of Mines and Minerals
 - Arizona Geological Survey
- Counties and municipalities

- Utilities:
 - Arizona Public Service
 - Salt River Project
 - Tucson Electric Power
- Environmental organizations:
 - Defenders of Wildlife
 - National Resources Defense Council
 - Sierra Club
 - Sonoran Institute
 - The Nature Conservancy
 - The Wilderness Society
 - Arizona Wilderness Coalition
 - Friends of the Sonoran Desert National Monument

6.6 POTENTIAL ADOPTION OF THE EIS BY OTHER ORGANIZATIONS

The RDEP EIS provides an analysis of the beneficial and adverse environmental, social, and economic impacts associated with renewable energy development on BLM-administered lands in Arizona. It identifies land use planning decisions, management actions, project design features, and best management practices that may be implemented to avoid, mitigate, or minimize potential impacts. The information contained in the EIS and the decisions represented here may be relevant to renewable energy development on other lands, including other federal, private, state-owned, and tribal lands. They also may be relevant to decisions regarding other related activities, including development of new transmission lines, substations, and other facilities.

Other agencies may elect to adopt this EIS, or a portion of this EIS, at some time in the future. The CEQ regulations provide specific guidance on the process by which one agency can adopt another agency's final environmental document even though it did not participate as a cooperating agency (40 CFR 1506.3). According to the CEQ in its March 23, 1981, "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," Question 30:

> "If the proposed action for which the EIS was prepared is substantially the same as the proposed action of the adopting agency, the EIS may be adopted as long as it is recirculated as a final EIS and the agency announces what it is doing. This would be followed by the 30-day review period and issuance of a Record of Decision by the adopting agency. If the proposed action by the adopting agency is not substantially the same as that in [46 FR

> 18036] the EIS (i.e., if an EIS on one action is being adapted for use in a decision on another action), the EIS would be treated as a draft and circulated for the normal public comment period and other procedures (46 FR 55, 18026-18038)."

Individual organizations should consider their own NEPA implementing regulations to evaluate the potential benefits associated with implementation of all or portions of the EIS.

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CHAPTER 7
LIST OF PREPARERS

This EIS was prepared by an interdisciplinary team of staff from the BLM, Environmental Management and Planning Solutions, Inc. (EMPSi), with their supporting subcontractor Environmental Planning Group. As discussed in **Chapter 6**, Consultation and Coordination, staff from numerous federal and state agencies, research institutions, industry, and non-profit organizations contributed to defining the planning area and project scope. The following is a list of people that prepared or contributed to the development of the EIS.

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GLOSSARY

Abandoned nest. A nest that was occupied by breeding birds earlier in the breeding season but was abandoned at some point during breeding (e.g., failed eggs, death of young).

Access roads. Gravel or dirt roads (rarely paved) that provide overland access to transmission line and pipeline rights-of-way (ROWs) and facilities for construction, inspection, maintenance, and decommissioning.

Active Management Areas (AMAs). Active Management Areas were established in Arizona to provide long-term management and conservation of limited groundwater supplies. In order to accomplish this, the AMAs administer state laws, explore ways of augmenting water supplies to meet future needs, and routinely work to develop public policy to promote efficient use and an equitable allocation of available water supplies.

Acquired lands. Acquired lands, as distinguished from public lands, are those lands in federal ownership which have been obtained by the Government by purchase, condemnation, or gift, or by exchange for such purchased, condemned or donated lands, or for timber on such lands.

Acquisition. Acquisition of lands can be pursued to facilitate various resource management objectives. Acquisitions, including easements, can be completed through exchange, Land and Water Conservation Fund purchases, donations, or receipts from the Federal Land Transaction Facilitation Act sales or exchanges.

Active nest site. A raptor nest site that is currently occupied by a pair of breeding raptors.

Activity plan. A type of implementation plan (see *Implementation plan*); an activity plan usually describes multiple projects and applies best management practices to meet land use plan objectives. Examples of activity plans include

interdisciplinary management plans, habitat management plans, recreation area management plans, and grazing plans.

Adaptive management. A type of natural resource management in which decisions are made as part of an ongoing science-based process. Adaptive management involves testing, monitoring, and evaluating applied strategies, and incorporating new knowledge into management approaches that are based on scientific findings and the needs of society. Results are used to modify management policy, strategies, and practices.

Adequate Water Supply Program. The Arizona Adequate Water Supply Program requires anyone who offers subdivided land outside of an Active Management Area for sale or lease to obtain a determination from the Arizona Department of Water Resources regarding the availability of water supplies before the land may be marketed to the public as defined in Arizona Administrative Code R12-15-715 et seq.

Administrative access. Administrative access pertains to travel on routes that are limited to authorized users (typically motorized access). These are existing routes that lead to developments that have an administrative purpose, where the BLM or a permitted user must have access for regular maintenance or operation.

Affected environment. For an environmental impact statement, a description of the existing environment covering information necessary to assess or understand the impacts. It must contain enough detail to support the impact analyses and must highlight environmentally sensitive resources (e.g., floodplains, wetlands, threatened and endangered species, and archeological resources).

Air basin. A land area with generally similar meteorological and geographic conditions throughout. To the extent possible, air basin boundaries are defined along political boundary lines and include both the source and receptor areas.

Air pollution. Degradation of air quality resulting from unwanted chemicals or other materials occurring in the air.

Air quality classes. Classifications established under the Prevention of Significant Deterioration portion of the Clean Air Act, which limits the amount of air pollution considered significant within an area. Class I applies to areas where almost any change in air quality would be significant; Class II applies to areas where the deterioration normally accompanying moderate well-controlled growth would be insignificant; and Class III applies to areas where industrial deterioration would generally be insignificant.

Airshed. A subset of air basin, the term denotes a geographical area that shares the same air because of topography, meteorology and climate.

Alkali. A mixture of soluble salts found in arid soils and some bodies of water, and as pure deposits in dry lake beds; detrimental to agriculture.

Allotment. An area of land in which one or more livestock operators graze their livestock. Allotments generally consists of BLM lands but may include other federally managed, state-owned, and private lands. An allotment may include or more separate pastures. Livestock numbers and periods of use are specified for each allotment.

Allotment management plan. A concisely written program of livestock grazing management, including supportive measures if required, designed to attain specific, multiple-use management goals in a grazing allotment. An allotment management plan is prepared in consultation with the permittee(s), lessee(s), and other affected interests. Livestock grazing is considered in relation to other uses of the range and to renewable resources, such as watershed, vegetation, and wildlife. An allotment management plan establishes seasons of use, the number of livestock to be permitted, the range improvements needed, and the grazing system.

Alluvial soil. A soil developing from recently deposited alluvium and exhibiting essentially no horizon development or modification of the recently deposited materials.

Alluvium. Clay, silt, sand, gravel, or other rock materials transported by moving water. Deposited in comparatively recent geologic time as sorted or semi-sorted sediment in rivers, floodplains, lakes, and shores, and in fans at the base of mountain slopes.

Alternative. A mix of management prescriptions applied to specific land areas to achieve a set of goals and objectives. Each alternative represents a different way of achieving a set of similar management objectives. Sometimes the term "action alternative" is used when it is desirable to recognize that there is a "no action" alternative under which the proposed activity would not take place.

Ambient air quality. The state of the atmosphere at ground level as defined by the range of measured and/or predicted ambient concentrations of all significant pollutants for all averaging periods of interest.

Ambient noise. The all-encompassing noise level associated with a given environment, being a composite of sounds from all sources.

Amendment. The process for considering or making changes in the terms, conditions, and decisions of approved Resource Management Plans or management framework plans. Usually only one or two issues are considered that involve only a portion of the planning area.

Animal unit month (AUM). The amount of forage necessary for the sustenance of one cow or its equivalent for a period of one month.

Aquatic. Living or growing in or on the water.

Area of Critical Environmental Concern (ACEC). Special Area designation established through the BLM's land use planning process (43 CFR 1610.7-2) where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. The level of allowable use within an ACEC is established through the collaborative planning process. Designation of an ACEC allows for resource use limitations in order to protect identified resources or values.

Attainment area. A geographic area in which levels of a criteria air pollutant meet the health-based National Ambient Air Quality Standard for that specific pollutant.

Augmentation Plan. A court-approved plan that allows a junior water user to divert water out of priority so long as adequate replacement is made to the affected stream system, preventing injury to the water rights of senior users.

Avoidance area. *See "right-of-way avoidance area" definition.*

Backcountry byway. Vehicle routes that traverse scenic corridors using secondary or backcountry road systems. National backcountry byways are designated by the type of road and vehicle needed to travel the byway.

Bald and Golden Eagle Protection Act. This Act was originally enacted in 1940 as the Bald Eagle Protection Act to protect bald eagles and later amended to include golden eagles. It prohibits the taking or possession of and commerce in bald and golden eagles, parts, feathers, nests, or eggs, with limited exceptions. The definition of take includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. Bald eagles may not be taken for any purpose unless a permit is issued prior to the taking. Permits must be obtained from the U.S. Department of the Interior to relocate nests that interfere with resource development or recovery.

Best Management Practice (BMP). A method, process, or activity, or usually a combination of these, that are determined by a State or a designated planning agency to be the most effective and practicable means (including technological, economic, and institutional considerations) of managing or controlling particular conditions or circumstances. BMPs are a suite of voluntary, accepted measures that may or may not be applied to or enforced for any given project.

Big game. Indigenous, ungulate (hoofed) wildlife species that are hunted, such as elk, deer, bison, bighorn sheep, and pronghorn antelope.

Biodiversity (biological diversity). The variety of life and its processes, and the interrelationships within and among various levels of ecological organization. Conservation, protection, and restoration of biological species and genetic diversity are needed to sustain the health of existing biological systems. Federal resource management agencies must examine the implications of management actions and development decisions on regional and local biodiversity.

Biological Opinion. A document prepared by US Fish and Wildlife Service stating their opinion as to whether or not a federal action will likely jeopardize the continued existence or adversely modify the habitat of a listed threatened or endangered species.

Biological soil crust. A complex association between soil particles and cyanobacteria, algae, microfungi, lichens, and bryophytes that live within or atop the uppermost millimeters of soil.

BLM Sensitive Species. Those species that are not federally listed as endangered, threatened, or proposed under the Endangered Species Act, but that are designated by the BLM State Director under 16 USC 1536(a)(2) for special management consideration. By national policy, federally listed candidate species are automatically included as sensitive species. Sensitive species are managed so they will not need to be listed as proposed, threatened, or endangered under the Endangered Species Act.

Candidate species. Taxa for which the US Fish and Wildlife Service has sufficient information on their status and threats to propose the species for listing as endangered or threatened under the Endangered Species Act, but for which issuance of a proposed rule is currently precluded by higher priority listing actions. Separate lists for plants, vertebrate animals, and invertebrate animals are published periodically in the Federal Register (BLM Manual 6840, Special Status Species Manual).

Categorical Exclusion. A category of actions (identified in agency guidance) that do not individually or cumulatively have a significant effect on the human environment, and for which neither an environmental assessment nor an environmental impact statement is required (40 CFR 1508.4), but a limited form of NEPA analysis is performed.

Center pivot irrigation. A form of sprinkler irrigation consisting of several segments of pipe (usually galvanized steel or aluminum) that are joined together and supported by trusses, mounted on wheeled towers with sprinklers positioned along its length. The system moves in a circular pattern and is fed with water from the pivot point at the center of the arc. These systems are

found and used in all parts of the nation and allow irrigation of all types of terrain.

Central Arizona Project Aqueduct. A 336-mile (541-kilometer) long diversion canal operated by the Central Arizona Water Conservation District that diverts water from the Colorado River into central and southern Arizona. The Central Arizona Project is the largest and most expensive aqueduct system ever built in the United States.

Citizen Wilderness Proposal. Areas that have been inventoried and proposed for Wilderness designation by citizens.

Clean Air Act (CAA) of 1963 and amendments. Federal legislation governing air pollution control.

Climate change. Any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from:

- natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- natural processes within the climate system (e.g. changes in ocean circulation); and
- human activities that change the atmosphere's composition (e.g. through burning fossil fuels) and the land surface (e.g. deforestation, reforestation, urbanization, desertification, etc.).

Climax vegetative community. The final vegetation community and highest ecological development of a plant community that emerges after a series of successive vegetational stages. The climax community perpetuates itself indefinitely unless disturbed by outside forces.

Closed area. An area where one or more uses are prohibited either temporarily or over the long term. Areas may be closed to uses such as, but not limited to, off-road vehicles, mineral leasing, mineral or vegetative material collection, or target shooting. In off-road vehicle use closed areas, motorized and mechanized off-road vehicle use is prohibited. Use of motorized and mechanized off-road vehicles in closed areas may be allowed for certain reasons; however, such use shall be made only with the approval of the authorized officer (43 CFR 8340.0-5).

Collaboration. A cooperative process in which interested parties, often with widely varied interests, work together to seek solutions with broad support for managing public and other lands. Collaboration may take place with any interested parties, whether or not they are a cooperating agency.

Collaborative partnerships. Refers to people working together, sharing knowledge and resources, to achieve desired outcomes for public lands and communities within statutory and regulatory frameworks.

Compact Linear Fresnel Reflector (CLFR). A type of Concentrated Solar Power (CSP) technology similar to a parabolic trough design, where the sun's heat energy is reflected onto a receiver positioned above the mirrors and containing water; the water is converted to steam and delivered to a Rankine cycle steam turbine-generator for production of electricity.

Compensatory mitigation. For purposes of the Clean Water Act Section 404 and Rivers and Harbors Act Section 10 regulatory programs, compensatory mitigation is the restoration, creation, enhancement, or, in exceptional circumstances, preservation of wetlands and/or other aquatic resources for the purpose of compensating for unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Concentrating PV (CPV). *See "Photovoltaic (PV) Module" definition.*

Concentrating solar collector. A solar collector that uses reflective surfaces to concentrate sunlight onto a small area, where it is absorbed and converted to heat or, in the case of solar photovoltaic (PV) devices, into electricity. Concentrators can increase the power flux of sunlight hundreds of times. The principal types of concentrating collectors include: compound parabolic, parabolic trough, fixed reflector moving receiver, fixed receiver moving reflector, Fresnel lens, and central receiver. A PV concentrating module uses optical elements (Fresnel lens) to increase the amount of sunlight incident onto a PV cell. Concentrating PV modules/arrays track the sun and use concentrating devices to reflect direct sunlight onto the solar cell to produce electricity directly. Concentrating solar collectors in Concentrated Solar Power (CSP) facilities concentrate sunlight onto a receiver where it heats a heat transfer fluid that subsequently exchanges its absorbed heat to water to produce steam to power a steam turbine-generator to produce electricity.

Concentrating Solar Power (CSP) Technologies. Any of a family of solar energy technologies that reflect and concentrate the sun's energy to produce heat that is subsequently used to produce steam to power a steam turbine-generator, or drive a reciprocating engine, to produce electricity. There are three different types of CSP systems: parabolic trough systems, power tower systems, and solar dish engine systems. Parabolic trough and power tower systems convert sunlight to heat to produce steam, while the solar dish engine system converts sunlight to heat to drive a reciprocating engine.

Concentrator. A photovoltaic module, which includes optical components such as lenses (Fresnel lens) to direct and concentrate sunlight onto a solar cell. Most concentrator arrays must directly face or track the sun. They can increase

the power flux of sunlight hundreds of times, allowing greatly increased amounts of power to be generated from relatively small areas of solar cells.

Conformance. A proposed action shall be specifically provided for in the land use plan or, if not specifically mentioned, shall be clearly consistent with the goals, objectives, or standards of the approved land use plan.

Conservation agreement. A formal signed agreement between the US Fish and Wildlife Service or National Oceanographic and Atmospheric Administration-Fisheries and other parties that implement specific actions, activities, or programs designed to eliminate or reduce threats to, or otherwise improve the status of, a species. Conservation agreements can be developed at a state, regional, or national level and generally include multiple agencies at both the state and federal level, as well as tribes. Depending on the types of commitments the BLM makes in a conservation agreement and the level of signatory authority, plan revisions or amendments may be required before the conservation agreement is signed or subsequently in order to implement the conservation agreement.

Conservation strategy. A strategy outlining current activities or threats that are contributing to the decline of a species, along with the actions or strategies needed to reverse or eliminate such a decline or threats. Conservation strategies are generally developed for species of plants and animals that are designated as BLM sensitive species or that have been determined by the US Fish and Wildlife Service or National Oceanographic and Atmospheric Administration-Fisheries to be federal candidates under the ESA.

Cooperating Agency. Assists the lead federal agency in developing an environmental assessment or environmental impact statement. These can be any agency with jurisdiction by law or special expertise for proposals covered by NEPA (40 CFR 1501.6). Any tribe or Federal, State, or local government jurisdiction with such qualifications may become a cooperating agency by agreement with the lead agency.

Corridor. A strip of land that aids in the movement of species between disconnected core areas of their natural habitat.

Council on Environmental Quality (CEQ). An advisory council to the President of the US established by the National Environmental Policy Act of 1969. It reviews federal programs to analyze and interpret environmental trends and information.

Criteria pollutant. The US EPA uses six "criteria pollutants" as indicators of air quality, and has established for each of them a maximum concentration above which adverse effects on human health may occur. These threshold concentrations are called National Ambient Air Quality Standards. The criteria

pollutants are ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter and lead.

Critical habitat. An area: A) designated by US Fish and Wildlife Service that is occupied by a threatened or endangered species "on which are found those physical and biological features (1) essential to the conservation of the species, and (2) which may require special management considerations or protection;" or B) on which are found those physical and biological features essential to the conservation of a species that may require special management consideration or protection.

Crucial habitat types. The environment essential to plant or animal biodiversity and conservation at the landscape level. Crucial habitats include, but are not limited to, biological core areas, severe winter range, winter concentration areas, reproduction areas, and movement corridors.

Cultural resources. Locations of human activity, occupation, or use. Cultural resources include archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and locations of traditional cultural or religious importance to specified social and/or cultural groups.

Cultural resources inventory. An inventory to assess the potential presence of cultural resources. There are three classes of surveys:

- **Class I.** An existing data survey. This is an inventory of a study area to (1) provide a narrative overview of cultural resources by using existing information, and (2) compile existing cultural resources site record data on which to base the development of the BLM's site record system.
- **Class II.** A sampling field inventory designed to locate, from surface and exposed profile indications, all cultural resource sites within a portion of an area so that an estimate can be made of the cultural resources for the entire area.
- **Class III.** An intensive field inventory designed to locate, from surface and exposed profile indications, all cultural resource sites in an area. Upon its completion, no further cultural resources inventory work is normally needed.

Cumulative effects. The direct and indirect effects of a proposed project alternative's incremental impacts when they are added to other past, present, and reasonably foreseeable actions, regardless of who carries out the action.

Decision Area. Lands and federal mineral estate within the planning area that are administered by the BLM.

Designated roads and trails. Specific roads and trails identified by the BLM (or other agency) where some type of motorized/nonmotorized use is appropriate and allowed, either seasonally or year-long (H-1601-1, BLM Land Use Planning Handbook).

Desired outcomes. A type of land use plan decision expressed as a goal or objective.

Disposal lands. Transfer of public land out of federal ownership to another party through sale, exchange, Recreation and Public Purposes Act of 1926, Desert Land Entry or other land law statutes.

Diversity. The relative abundance of wildlife species, plant species, communities, habitats, or habitat features per unit of area.

Easement. A right afforded a person or agency to make limited use of another's real property for access or other purposes.

Electric and Magnetic Fields (EMFs). Electric and magnetic fields are generated when charged particles (e.g., electrons) are accelerated. Charged particles in motion produce magnetic fields. Electric and magnetic fields are typically generated by alternating current in electrical conductors. Also referred to as electromagnetic fields.

Ecologic functionality. These levels include successional processes that are in place, energy and nutrients that are being cycled effectively, and soil that is being appropriately stabilized. An area can be functioning at a basic level of ecologic functionality without meeting land health standards.

Eligible river. A river that qualifies for inclusion into the National WSR System through professional judgment that it is free flowing and, with its adjacent land area, possesses at least one river-related value considered to be outstandingly remarkable (M-8351, BLM WSR Policy and Program).

Endangered species. Any species that is in danger of extinction throughout all or a significant portion of its range (BLM Manual 6840, Special Status Species Manual). Under the Endangered Species Act in the US, "endangered" is the more-protected of the two categories. Designation as endangered (or threatened) is determined by USFWS as directed by the Endangered Species Act.

Endangered Species Act of 1973. Designed to protect critically imperiled species from extinction as a consequence of economic growth and development untempered by adequate concern and conservation. The Act is administered by two federal agencies, USFWS and the National Oceanic and Atmospheric Administration. The purpose of the Act is to protect species and also the ecosystems upon which they depend (16 US Code 1531-1544).

Environmental assessment (EA). A concise public document prepared to provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact. It includes a brief discussion of the need for the proposal, alternatives considered, environmental impact of the proposed action and alternatives, and a list of agencies and individuals consulted.

Environmental impact statement (EIS). A detailed statement prepared by the responsible official in which a major federal action that significantly affects the quality of the human environment is described, alternatives to the proposed action are provided, and effects are analyzed (BLM National Management Strategy for OHV Use on Public Lands).

Evaluation (plan evaluation). The process of reviewing the land use plan and the periodic plan monitoring reports to determine whether the land use plan decisions and National Environmental Policy Act of 1969 analysis are still valid and whether the plan is being implemented.

Exchange. A transaction whereby the federal government receives land or interests in land in exchange for other land or interests in land.

Exclusion area. *See "right-of-way exclusion area" definition.*

Existing routes. The roads, trails, or ways that are used by motorized vehicles (jeeps, all-terrain vehicles, motorized dirt bikes, etc.), mechanized uses (mountain bikes, wheelbarrows, game carts), pedestrians (hikers), and/or equestrians (horseback riders) and are, to the best of BLM's knowledge, in existence at the time of RMP/EIS publication.

Extensive recreation management area (ERMA). Administrative units that require specific management consideration in order to address recreation use, demand, or Recreation and Visitor Services program investments. ERMAs are managed to support and sustain the principal recreation activities and the associated qualities and conditions of the ERMA. ERMA management is commensurate and considered in context with the management of other resources and resource uses.

Federal Land Policy and Management Act of 1976 (FLPMA). Public Law 94-579, October 21, 1976, often referred to as the BLM's "Organic Act," which provides most of the BLM's legislated authority, direction policy, and basic management guidance (BLM National Management Strategy for OHV Use on Public Lands).

Federal mineral estate. Subsurface mineral estate owned by the US and administered by the BLM.

Fire Management Plan (FMP). A plan that identifies and integrates all wildland fire management and related activities within the context of approved land/resource management plans. It defines a program to manage wildland fires (wildfire, prescribed fire, and wildland fire use). The plan is supplemented by operational plans including, but not limited to, preparedness plans, preplanned dispatch plans, and prevention plans. Fire Management Plans assure that wildland fire management goals and components are coordinated.

Fire severity. Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.

Fire suppression. All work and activities connected with control and fire-extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Fluid minerals. Oil, gas, coal bed natural gas, and geothermal resources.

Forage. All browse and herbaceous foods that are available to grazing animals.

Four-wheel drive vehicle. A passenger vehicle or truck having power available to all wheels. Any motorized vehicle that has generally higher clearance than a passenger car and has traction on all four wheels.

Fragile soils. Soils having a shallow depth to bedrock, minimal surface layer of organic material, textures that are more easily detached and eroded, or are on slopes over 35 percent.

Geographic Information System (GIS). A system of computer hardware, software, data, people, and applications that capture, store, edit, analyze, and display a potentially wide array of geospatial information.

Geothermal energy. Natural heat from within the Earth captured for production of electric power, space heating, or industrial steam.

Goal. A broad statement of a desired outcome; usually not quantifiable and may not have established timeframes for achievement.

Grandfathered right. The right to use in a non-conforming manner due to existence prior to the establishment of conforming terms and conditions.

Grazing system. Scheduled grazing use and non-use of an allotment to reach identified goals or objectives by improving the quality and quantity of vegetation. Include, but are not limited to, developing pastures, utilization levels, grazing rotations, timing and duration of use periods, and necessary range improvements.

Groundwater. Water held underground in soil or permeable rock, often feeding springs and wells.

Guidelines. Actions or management practices that may be used to achieve desired outcomes, sometimes expressed as BMPs. Guidelines may be identified during the land use planning process, but they are not considered a land use plan decision unless the plan specifies that they are mandatory. Guidelines for grazing administration must conform to 43 CFR 4180.2.

Habitat. An environment that meets a specific set of physical, biological, temporal, or spatial characteristics that satisfy the requirements of a plant or animal species or group of species for part or all of their life cycle.

Habitat Management Plan (HMP). A written and approved activity plan for a geographical area which identifies habitat management activities to be implemented in achieving specific objectives of planning decisions.

Hazardous material. A substance, pollutant, or contaminant that, due to its quantity, concentration, or physical or chemical characteristics, poses a potential hazard to human health and safety or to the environment if released into the workplace or the environment.

Herd management area. Public land under the jurisdiction of the BLM that has been designated for special management emphasizing the maintenance of an established wild horse or burro herd.

Historic resources. Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places.

Hybrid (wet-dry cooling) systems. A variation on a dry cooling system. In this hybrid system, small amounts of water are sprayed as a fine mist into the flow of ambient air being directed over the surface of a dry condenser. The water evaporates, cooling the air as it does so. Alternatively, water is deluged over the surface of the dry condenser where it evaporates after interacting with the overflowing ambient air stream, cooling that air. Wet/dry hybrid systems consume only minor amounts of water (compared to wet closed-loop cooling) but offer significantly better performance than dry cooling systems, especially in hot climates with low relative humidity.

Impact. The effect, influence, alteration, or imprint caused by an action.

Impairment. The degree to which a distance of clear visibility is degraded by man-made pollutants.

Implementation decisions. Decisions that take action to implement land use planning; generally appealable to Interior Board of Land Appeals under 43 CFR 4.410.

Implementation plan. An area or site-specific plan written to implement decisions made in a land use plan. Implementation plans include both activity plans and project plans.

Indian Trust Assets. Legal interests in property, physical assets, or intangible property rights held in trust by the United States for Indian tribes or individual Indians.

Intermittent stream. An intermittent stream is a stream that flows only at certain times of the year when it receives water from springs or from some surface sources such as melting snow in mountainous areas. During the dry season and throughout minor drought periods, these streams will not exhibit flow. Geomorphological characteristics are not well defined and are often inconspicuous. In the absence of external limiting factors, such as pollution and thermal modifications, species are scarce and adapted to the wet and dry conditions of the fluctuating water level.

Invertebrate. An animal lacking a backbone or spinal column, such as insects, snails, and worms. The group includes 97 percent of all animal species.

Irrigation. The controlled application of water for agricultural purposes through manmade systems to supply water requirements that are not satisfied by rainfall.

Irrigation Non-Expansion Area (INA). A geographic area in Arizona that has been designated as having insufficient groundwater to provide a reasonably safe supply for the irrigation of the cultivated lands at the current rate of withdrawal.

K factor. A soil erodibility factor used in the universal soil loss equation that is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. Estimation of the factor takes several soil parameters into account, including soil texture, percent of sand greater than 0.10 millimeter, soil organic matter content, soil structure, soil permeability, clay mineralogy, and coarse fragments. K factor values range from .02 to .64, the greater values indicating the highest susceptibilities to erosion.

Land classification. When, under criteria of 43 CFR 2400, a tract of land has the potential for retention for multiple use management or for some form of disposal or for more than one form of disposal. The relative scarcity of the values involved and the availability of alternative means and sites for realization of those values will be considered. Long-term public benefits will be weighed against more immediate or local benefits. The tract will then be classified in a manner that will best promote the public interest.

Land health condition. A classification for land health which includes these categories: "Not Meeting Standard(s)," "Meeting Standard(s) with Problems," "Meeting Land Health Standard(s)," and "Exceeding Land Health Standard(s)."

- **Not Meeting Standard(s).** Lands which have one or more serious concerns with indicators to the degree that they are categorized as not meeting one or more of the Land Health Standards.
- **Meeting Standard(s) with Problems.** Lands which have one or more minor concerns with indicators to the degree that they are categorized as meeting the Land Health Standards, but flagged as having some issues which would generally benefit from management.
- **Meeting Standard(s) with Problems with a Downward Trend.** Lands which have one or more minor concerns with indicators to the degree that they are categorized as meeting the Land Health Standards, but flagged as having some issues, and which have shown declining conditions of those indicators over time.
- **Meeting Standard(s).** Lands which have none or very few or minor concerns with indicators, and all Land Health Standards are met.
- **Exceeding Standard(s).** Lands which show good or exceptional conditions for indicators and which meet all Land Health Standards

Land tenure adjustments. Land ownership or jurisdictional changes. To improve the manageability of the BLM lands and their usefulness to the public, the BLM has numerous authorities for repositioning lands into a more consolidated pattern, disposing of lands, and entering into cooperative management agreements. These land pattern improvements are completed primarily through the use of land exchanges but also through land sales, through jurisdictional transfers to other agencies, and through the use of cooperative management agreements and leases.

Land use allocation. The identification in a land use plan of the activities and foreseeable development that are allowed, restricted, or excluded for all or part of the planning area, based on desired future conditions (H-1601-1, BLM Land Use Planning Handbook).

Land use plan. A set of decisions that establish management direction for land within an administrative area, as prescribed under the planning provisions of FLPMA; an assimilation of land use plan level decisions developed through the planning process outlined in 43 CFR 1600, regardless of the scale at which the decisions were developed. The term includes both RMPs and management framework plans (from H-1601-1, BLM Land Use Planning Handbook).

Land use plan boundary. The geographic extent of a resource management plan or management framework plans.

Land use plan decision. Establishes desired outcomes and actions needed to achieve them. Decisions are reached using the planning process in 43 CFR 1600. When they are presented to the public as proposed decisions, they can be protested to the BLM Director. They are not appealable to Interior Board of Land Appeals.

Leasable minerals. Those minerals or materials designated as leasable under the Mineral Leasing Act of 1920. These include energy-related mineral resources such as oil, natural gas, coal, and geothermal, and some non-energy minerals, such as phosphate, sodium, potassium, and sulfur. Geothermal resources are also leasable under the Geothermal Steam Act of 1970.

Lease. Section 302 of the Federal Land Policy and Management Act of 1976 provides the BLM's authority to issue leases for the use, occupancy, and development of public lands. Leases are issued for purposes such as a commercial filming, advertising displays, commercial or noncommercial croplands, apiaries, livestock holding or feeding areas not related to grazing permits and leases, native or introduced species harvesting, temporary or permanent facilities for commercial purposes (does not include mining claims), residential occupancy, ski resorts, construction equipment storage sites, assembly yards, oil rig stacking sites, mining claim occupancy if the residential structures are not incidental to the mining operation, and water pipelines and well pumps related to irrigation and nonirrigation facilities. The regulations establishing procedures for processing these leases and permits are found in 43 CFR 2920.

Lease notice. Provides more-detailed information concerning limitations that already exist in law, lease terms, regulations, or operational orders. A lease notice also addresses special items that lessees should consider when planning operations but does not impose additional restrictions. Lease notices are not an RMP-level decision, and new lease notices may be added to fluid mineral leases at the time of sale. Lease notices apply only to leasable minerals (e.g., oil, gas, geothermal) and not to other types of leases, such as livestock grazing.

Lease stipulation. A modification of the terms and conditions on a standard lease form at the time of the lease sale.

Limited area. An area restricted at certain times, in certain areas, and/or to certain vehicular use. These restrictions may be of any type, but can generally be accommodated within the following type of categories: Numbers of vehicles; types of vehicles; time or season of vehicle use; permitted or licensed use only; use on existing roads and trails; use on designated roads and trails; and other restrictions (43 CFR 8340.0-5).

Lithic site. An archaeological site containing debris left from the manufacture, use, or maintenance of flaked stone tools.

Locatable minerals. Minerals subject to exploration, development, and disposal by staking mining claims as authorized by the Mining Law of 1872, as amended. This includes deposits of gold, silver, and other uncommon minerals not subject to lease or sale.

Long-term effect. The effect could occur for an extended period after implementation of the alternative. The effect could last several years or more.

Ma. Millions of years ago.

Management decision. A decision made by the BLM to manage public lands. Management decisions include both land use plan decisions and implementation decisions.

Mechanized uses. Equipment that is mechanized, including but not limited to mountain bikes, wheelbarrows, and game carts.

Mineral. Any naturally formed inorganic material, solid or fluid inorganic substance that can be extracted from the earth, any of various naturally occurring homogeneous substances (as stone, coal, salt, sulfur, sand, petroleum, water, or natural gas) obtained usually from the ground. Under federal laws, considered as locatable (subject to the general mining laws), leasable (subject to the Mineral Leasing Act of 1920), and salable (subject to the Materials Act of 1947).

Mineral entry. The filing of a claim on public land to obtain the right to any locatable minerals it may contain.

Mineral estate. The ownership of minerals, including rights necessary for access, exploration, development, mining, ore dressing, and transportation operations.

Mineralize. The process where a substance is converted from an organic substance to an inorganic substance.

Mineral materials (salable minerals, salable mineral materials). Common varieties of mineral materials such as soil, sand and gravel, stone, pumice, pumicite, and clay that are not obtainable under the mining or leasing laws but that can be acquired under the Materials Act of 1947, as amended.

Mineral patent. A claim on which title has passed from the federal government to the mining claimant under the Mining Law of 1872.

Mining claim. A parcel of land that a miner takes and holds for mining purposes, having acquired the right of possession by complying with the Mining

Law and local laws and rules. A mining claim may contain as many adjoining locations as the locator may make or buy. There are four categories of mining claims: lode, placer, millsite, and tunnel site.

Mining Law of 1872. Provides for claiming and gaining title to locatable minerals on public lands. Also referred to as the "General Mining Laws" or "Mining Laws."

Mitigation. Alleviation or lessening of possible adverse effects on a resource by applying appropriate protective measures or adequate scientific study. Mitigation may be achieved by avoidance, minimization, rectification, reduction, and compensation.

Modification. A change to the provisions of a lease stipulation, either temporarily or for the term of the lease. Depending on the specific modification, the stipulation may or may not apply to all sites within the leasehold to which the restrictive criteria are applied.

Monitoring (plan monitoring). The process of tracking the implementation of land use plan decisions and collecting and assessing data necessary to evaluate the effectiveness of land use planning decisions.

Motorcycle. A motorized vehicle with two tires and with a seat designed to be straddled by the operator.

Motorized vehicles or uses. Vehicles that are motorized, including but not limited to jeeps, all-terrain vehicles (all-terrain vehicles, such as four-wheelrs and three-wheelers), and tra motorcycles or dirt bikes.

Multiple-use. The management of the public lands and their various resource values so that they are used in the combination that will best meet the present and future needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to changing needs and conditions; the use of some land for less than all of the resources; a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output (FLPMA) (BLM Manual 6840, Special Status Species Manual).

Municipal watershed. A watershed area that provides water for use by a municipality as defined by the community and accepted by the State.

National Environmental Policy Act of 1969 (NEPA). Public Law 91-190. Establishes environmental policy for the nation. Among other items, NEPA requires federal agencies to consider environmental values in decision-making processes.

National Register of Historic Places. A listing of architectural, historical, archaeological, and cultural sites of local, state, or national significance, established by the Historic Preservation Act of, 1966 and maintained by the National Park Service.

National Wild and Scenic Rivers System (NWSRS). A system of nationally designated rivers and their immediate environments that have outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, and other similar values and are preserved in a free-flowing condition. The system consists of three types of streams: (1) recreation—rivers or sections of rivers that are readily accessible by road or railroad and that may have some development along their shorelines and may have undergone some impoundments or diversion in the past; (2) scenic—rivers or sections of rivers free of impoundments with shorelines or watersheds still largely undeveloped but accessible in places by roads; and (3) wild—rivers or sections of rivers free of impoundments and generally inaccessible except by trails, with watersheds or shorelines essentially primitive and waters unpolluted.

Native vegetation. Plant species which were found here prior to European settlement, and consequently are in balance with these ecosystems because they have well developed parasites, predators, and pollinators.

Naturalness. Consistent with what would occur without human intervention. For vegetation structure, naturalness implies a pattern similar to what fire and climate would produce across the landscape.

Natural processes. Fire, drought, insect and disease outbreaks, flooding, and other events which existed prior to European settlement, and shaped vegetation composition and structure.

Non-energy leasable minerals. Those minerals or materials designated as leasable under the Mineral Leasing Act of 1920. Non-energy minerals include resources such as phosphate, sodium, potassium, and sulfur.

Noxious weeds. A plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive and difficult to manage; parasitic; a carrier or host of serious insects or disease; or nonnative, new, or not common to the US.

Objective. A description of a desired outcome for a resource. Objectives can be quantified and measured and, where possible, have established timeframes for achievement.

Off-highway vehicle (OHV) (off-road vehicle). Any motorized vehicle capable of, or designated for travel on or immediately over land, water or other natural terrain, excluding: (1) any non-amphibious registered motorboat; (2) any military, fire, emergency, or law enforcement vehicle while being used for emergency purposes; (3) any vehicle whose use is expressly authorized by the authorized officer, or otherwise officially approved; (4) vehicles in official use; and (5) any combat or combat support vehicle when used for national defense emergencies (43 CFR 8340.0-5).

Off-highway vehicle area designations. BLM-administered lands are designated as Open, Limited, or Closed for OHV use.

- **Open.** An area where all types of vehicle use is permitted at all times, anywhere in the area subject to the operating regulations and vehicle standards set forth in 43 CFR subparts 8341 and 8342 (43 CFR 8340.0-5).
- **Limited.** An area restricted at certain times, in certain areas, and/or to certain vehicular use. These restrictions may be of any type, but can generally be accommodated within the following type of categories: Numbers of vehicles; types of vehicles; time or season of vehicle use; permitted or licensed use only; use on existing roads and trails; use on designated roads and trails; and other restrictions (43 CFR 8340.0-5).
- **Closed.** An area where off-road vehicle use is prohibited. Use of off-road vehicles in closed areas may be allowed for certain reasons; however, such use shall be made only with the approval of the authorized officer (43 CFR 8340.0-5).

Old-growth forest stands. Stands composed of trees that are generally in the late successional stages of development. The desired attributes of old-growth stands are older, large trees for the species and site; signs of decadence (broken or deformed tops or boles and some root decay); multiple layers of canopy; standing and down dead trees; a variation in tree age, size, and spacing; and gaps or patchiness in the canopy and understory (Mehl 1992).

Open. Generally denotes that an area is available for a particular use or uses. Refer to specific program definitions found in law, regulations, or policy guidance for application to individual programs. For example, 43 CFR 8340.0-5 defines the specific meaning of "open" as it relates to OHV use.

Ordinary high water mark. That line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear,

natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

Outstandingly remarkable value (ORV). Values among those listed in Section 1(b) of the Wild and Scenic Rivers Act of 1968: "scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar values..." Other similar values that may be considered include ecological, biological, or botanical.

Overstory. That portion of a plant community consisting of the taller plants on the site; the forest or woodland canopy.

Ozone. A faint blue gas produced in the atmosphere from chemical reactions of burning coal, gasoline, and other fuels and chemicals found in products such as solvents, paints, and hairsprays.

Paleontological resources. The physical remains or other physical evidence of plants and animals preserved in soils and sedimentary rock formations. Paleontological resources are important for correlating and dating rock strata and for understanding past environments, environmental change, and the evolution of life.

Parabolic trough. A type of CSP Solar Energy technology that uses parabolic-shaped mirrors to concentrate sunlight on a receiver filled with a heat transfer fluid that subsequently transfers the heat it absorbs to water to produce steam to drive a steam turbine-generator to produce electricity. Parabolic Trough systems typically mount the mirrors on a support that can track the sun's movement across the sky over the course of the day, ensuring maximum solar energy capture.

Particulate matter (PM). One of the six "criteria" pollutants for which the US EPA established National Ambient Air Quality Standards. Particulate matter is defined as two categories, fine particulates, with an aerodynamic diameter of 10 micrometers (PM_{10}) or less, and fine particulates with an aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$).

Passenger vehicle. Two-wheel-drive, low-clearance vehicles.

Patent. A grant made to an individual or group conveying fee simple title to selected public lands pursuant to various land disposal laws.

Perennial stream. A stream that flows continuously. Perennial streams are generally associated with a water table in the localities through which they flow.

Permittee. A person or company permitted to graze livestock on public land.

Petroglyph. A form of rock art created by incising, scratching or pecking designs into rock surfaces.

Photovoltaic (PV) array. An interconnected system of PV modules that function as a single electricity-producing unit. The modules are assembled as a discrete structure, with common support or mounting. In smaller capacity systems, an array can consist of a single module.

Photovoltaic (PV) cell. The smallest semiconductor element within a PV module that converts incident sunlight into electrical energy (direct current voltage and current). Also called a solar cell.

Photovoltaic (PV) facility. A solar energy facility that uses photovoltaic cells to produce electricity and that includes all components, such as the PV system, power conditioning equipment, monitoring and control capabilities, and other features required for safe connection of the facility to the bulk electricity transmission grid, as well as buildings, access roads, perimeter fence, and other equipment needed for operation and maintenance of the facility.

Photovoltaic (PV) module. An assembly of solar cells (flat-plate type) or receiver(s) and optics (concentrator type) and ancillary parts, such as interconnects and terminals, enclosed in a weatherproof container, intended to generate DC power under unconcentrated sunlight. (Note: A CPV module is a concentrator type PV module.) The structural (load carrying) member of a module can either be the top layer (superstrate) or the back layer (substrate).

Photovoltaic (PV) panel. A collection of modules, either flat-plate or concentrator type, mechanically fastened, electrically interconnected, and designed to provide a field-installable unit. (Note: Not all PV systems will use panelized units during installation. Sometimes the modules are individually attached to a support structure.)

Physiography. The study and classification of the surface features of the earth.

Pictograph. A form of rock art created by applying mineral based or organic paint to rock surfaces.

Planning Area. The geographical area for which resource management plans are developed and maintained.

Planning criteria. The standards, rules, and other factors developed by managers and interdisciplinary teams for their use in forming judgments about decision making, analysis, and data collection during planning. Planning criteria streamlines and simplifies the resource management planning actions.

Planning issues. Concerns, conflicts, and problems with the existing management of public lands. Frequently, issues are based on how land uses

affect resources. Some issues are concerned with how land uses can affect other land uses, or how the protection of resources affects land uses.

Potential Fossil Yield Classification (PFYC) System. A system used by the BLM to classify geologic units based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential.

Potential vegetation group. Potential vegetation types grouped on the basis of a similar general moisture or temperature environment.

Power tower. A type of CSP technology comprised of many large, sun-tracking mirrors (heliostats) that focus sunlight on a receiver at the top of a centrally located tower. The sunlight heats up a heat transfer fluid in the receiver, which then is used to generate steam (or directly heats water to produce steam) that powers a steam turbine-generator to produce electricity. Power tower systems can also be equipped with molten salt in which the heat generated at the receiver can be stored for delayed production of electricity.

Prehistoric resources. Any material remains, structures, and items used or modified by people before Euro-Americans established a presence in the region.

Prescribed fire. A wildland fire originating from a planned ignition to meet specific objectives identified in a written, approved, prescribed fire plan for which NEPA requirements (where applicable) have been met prior to ignition.

Prevention of significant deterioration (PSD). An air pollution permitting program intended to ensure that air quality does not diminish in attainment areas.

Primitive and unconfined recreation. Nonmotorized, nonmechanized (except as provided by law), and undeveloped types of recreational activities. Bicycles are considered mechanical transport, so their use is not considered primitive and unconfined recreation (H-6310-1, Wilderness Inventory and Study Procedures).

Primitive road. A linear route managed for use by four-wheel drive or high-clearance vehicles. Primitive roads do not normally meet any BLM road design standards.

Proper functioning condition. A term describing stream health that is based on the presence of adequate vegetation, landform and debris to dissipate energy, reduce erosion and improve water quality.

Proposed critical habitat. Those areas officially proposed for designations as critical habitat by the Secretary of Interior or Commerce.

Proposed species. A species for which a proposed rule to add the species to the federal list of threatened and endangered species has been published in the Federal Register.

Public land. Land or interest in land owned by the US and administered by the Secretary of the Interior through the BLM without regard to how the US acquired ownership, except lands located on the Outer Continental Shelf and land held for the benefit of Indians, Aleuts, and Eskimos (H-1601-1, BLM Land Use Planning Handbook).

Raptor. Bird of prey with sharp talons and strongly curved beaks, such as hawks, owls, falcons, and eagles.

Reasonable foreseeable development scenario (RFDs). The prediction of the type and amount of oil and gas activity that would occur in a given area. The prediction is based on geologic factors, past history of drilling, projected demand for oil and gas, and industry interest.

Reclamation. Returning disturbed lands to a form and productivity that will be ecologically balanced and in conformity with a predetermined land management plan.

Recreation and Public Purposes Act of 1926. Provides for the lease and sale of public lands determined valuable for public purposes. The objective of the R&PP Act is to meet the needs of state and local government agencies and nonprofit organizations by leasing or conveying public land required for recreation and public purpose uses. Examples of uses made of R&PP lands are parks and greenbelts, sanitary landfills, schools, religious facilities, and camps for youth groups. The act provides substantial cost-benefits for land acquisition and provides for recreation facilities or historical monuments at no cost.

Recreation experiences. Psychological outcomes realized either by recreation-tourism participants as a direct result of their on-site leisure engagements and recreation-tourism activity participation or by nonparticipating community residents as a result of their interaction with visitors and guests within their community or interaction with the BLM and other public and private recreation-tourism providers and their actions.

Recreation management zones. Subunits within a SRMA managed for distinctly different recreation products. Recreation products are composed of recreation opportunities, the natural resource and community settings within which they occur, and the administrative and service environment created by all affecting recreation-tourism providers, within which recreation participation occurs.

Recreation settings. The collective distinguishing attributes of landscapes that influence and sometimes actually determine what kinds of recreation opportunities are produced.

Rehabilitate. Returning disturbed lands as near to its predisturbed condition as is reasonably practical or as specified in approved permits.

Renewable Energy. Energy resources that constantly renew themselves or that are regarded as practically inexhaustible. These include solar, wind, geothermal, hydro, and biomass. Although particular geothermal formations can be depleted, the natural heat in the Earth is a virtually inexhaustible reserve of potential energy.

Research Natural Area (RNA). A land management status which reserves the area for uses that are compatible with the resource of interest and research for which the area was designated.

Resource Advisory Council (RAC). A council established by the Secretary of the Interior to provide advice or recommendations to BLM management.

Resource management plan (RMP). A land use plan as prescribed by the Federal Land Policy and Management Act that establishes, for a given area of land, land-use allocations, coordination guidelines for multiple-use, objectives, and actions to be achieved.

Restore/restoration. The process of returning disturbed areas to a natural array of native plant and animal associations.

Revegetate/revegetation. The process of putting vegetation back in an area where vegetation previously existed, which may or may not simulate natural conditions.

Revision. The process of completely rewriting the land use plan due to changes in the planning area affecting major portions of the plan or the entire plan.

Right-of-way (ROW). Public lands authorized to be used or occupied for specific purposes pursuant to a right-of-way grant, which are in the public interest and which require ROWs over, on, under, or through such lands.

Right-of-way avoidance area. An area identified through resource management planning to be avoided but may be available for ROW location with special stipulations.

Right-of-way exclusion area. An area identified through resource management planning that is not available for ROW location under any conditions.

Riparian/aquatic system. Interacting system between aquatic and terrestrial situations. Identified by a stream channel and distinctive vegetation that requires or tolerates free or unbound water.

Riparian area. A form of wetland transition between permanently saturated wetlands and upland areas. Riparian areas exhibit vegetation or physical characteristics that reflect the influence of permanent surface or subsurface water. Typical riparian areas include lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels. Excluded are ephemeral streams or washes that lack vegetation and depend on free water in the soil.

Riparian zone. An area one-quarter mile wide encompassing riparian and adjacent vegetation.

Road. A linear route declared a road by the owner, managed for use by low-clearance vehicles having four or more wheels, and maintained for regular and continuous use.

Roadless. The absence of roads that have been constructed and maintained by mechanical means to ensure regular and continuous use.

Rock art. Petroglyphs (carvings) or pictographs (painting) used by native persons to depict their history and culture.

Routes. Multiple roads, trails and primitive roads; a group or set of roads, trails, and primitive roads that represents less than 100 percent of the BLM transportation system. Generically, components of the transportation system are described as "routes."

Sale (public land). A method of land disposal pursuant to Section 203 of FLPMA, whereby the US receives a fair-market payment for the transfer of land from federal ownership. Public lands determined suitable for sale are offered on the initiative of the BLM.Lands suitable for sale must be identified in the RMP. Any lands to be disposed of by sale that are not identified in the current RMP, or that meet the disposal criteria identified in the RMP, require a plan amendment before a sale can occur.

Salinity. Refers to the solids such as sodium chloride (table salt) and alkali metals that are dissolved in water.

Saturated soils. Occur when the infiltration capacity of the soil is exceeded from above due to rainfall or snowmelt runoff. Soils can also become saturated from groundwater inputs.

Scenic byways. Highway routes that have roadsides or corridors of special aesthetic, cultural, or historical value. An essential part of the highway is its scenic corridor. The corridor may contain outstanding scenic vistas, unusual geologic features, or other natural elements.

Scenic river. A river or section of a river that is free of impoundments and whose shorelines are largely undeveloped but accessible in places by roads.

Scoping process. An early and open public participation process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.

Seeding. Seeding is a vegetation treatment that includes the application of grass, forb, or shrub seed, either aerially or from the ground. In areas of gentle terrain, ground applications of seed are often accomplished with a rangeland drill. Seeding allows the establishment of native species or placeholder species and restoration of disturbed areas to a perennial-dominated cover type, thereby decreasing the risk of subsequent invasion by exotic plant species. Seeding would be used primarily as a follow-up treatment in areas where disturbance or the previously described treatments have removed exotic plant species and their residue.

Short-term effect. The effect occurs only during or immediately after implementation of the alternative.

Sole-source aquifer. Defined by the US EPA as an aquifer supplying at least 50 percent of the drinking water consumed in the area overlying the aquifer, where the surrounding area has no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water.

Solitude. The state of being alone or remote from habitations; isolation. A lonely or secluded place. Factors contributing to opportunities for solitude may include size, natural screening, topographic relief, vistas, physiographic variety, and the ability of the user to find a secluded spot.

Source water protection area. The area delineated by a state for a public water supply or including numerous suppliers, whether the source is ground water or surface water or both.

Special recreation management area (SRMA). An administrative public lands unit identified in land use plans where the existing or proposed recreation opportunities and recreation setting characteristics are recognized for their unique value, importance, and/or distinctiveness, especially as compared to other areas used for recreation.

Special recreation permit (SRP). Authorization that allows for recreational uses of public lands and related waters. Issued as a means to control visitor use, protect recreational and natural resources, and provide for the health and safety of visitors. Commercial SRPs are also issued as a mechanism to provide a fair return for the commercial use of public lands.

Special status species (BLM). BLM special status species are: (1) species listed or proposed for listing under the Endangered Species Act; and (2) species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the Endangered Species Act that are designated as BLM sensitive by the BLM State Director(s). All federally listed candidate species, proposed species, and delisted species in the five years following delisting are conserved as BLM sensitive species.

Split estate. Lands on which the mineral estate is owned by someone other than the surface estate owner. For example, the surface is in private ownership and the mineral resources are publicly held and managed by the federal government.

Standard lease terms and conditions. Areas may be open to leasing with no specific management decisions defined in a Resource Management Plan; however, these areas are subject to lease terms and conditions as defined on the lease form (Form 3100-11, Offer to Lease and Lease for Oil and Gas; and Form 3200-24, Offer to Lease and Lease for Geothermal Resources).

State implementation plan. A detailed description of the programs a state will use to carry out its responsibilities under the Clean Air Act. State implementation plans are collections of the regulations used by a state to reduce air pollution.

Stationary source. Refers to a stationary source of emissions. Prevention of Significant Deterioration permits are required for major new stationary sources of emissions that emit 100 tons or more per year of carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, or particulate matter.

Stipulation (general). A term or condition in an agreement or contract.

Stipulation (oil and gas). A provision that modifies standard oil and gas lease terms and conditions in order to protect other resource values or land uses and is attached to and made a part of the lease. Typical lease stipulations include No Surface Occupancy (NSO), Timing Limitations (TL), and Controlled Surface Use (CSU). Lease stipulations are developed through the land use planning (RMP) process.

Streamside management zone. Land adjacent to a waterbody where activities on land are likely to affect water quality.

Suitable river. A river segment found, through administrative study by an appropriate agency, to meet the criteria for designation as a component of the National Wild and Scenic Rivers system, specified in Section 4(a) of the Wild and Scenic Rivers Act.

Surface-disturbing activities. Human-caused disturbance resulting in direct and pronounced alteration, damage, removal, displacement, or mortality of vegetation, soil, or substrates; usually entail motorized or mechanized vehicles or tools; typically can also be described as disruptive activities (see following definition). Examples of typical surface disturbing activities include:

- Earth-moving and drilling;
- Geophysical exploration;
- Off-route motorized and mechanized travel;
- Vegetation treatments including woodland thinning with chainsaws;
- Pyrotechnics and explosives; and
- Construction of powerlines, pipelines, oil and gas wells, recreation sites, livestock improvement facilities, wildlife waters, or new roads.

Examples of casual use and other activities that would not normally be considered surface disturbing activities include:

- Equestrian use;
- Proper livestock grazing;
- Cross-country hiking;
- Hand-spraying weeds;
- Minimal trimming of vegetation to maintain ROWs;
- Motorized and mechanized travel on designated routes; and
- Maintenance of permitted areas under valid existing rights.

Sustained yield. The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the public lands consistent with multiple use.

Terrestrial. Living or growing in or on the land.

Threatened species. Any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (BLM Manual 6840, Special Status Species Management). Under the Endangered Species Act in the US, "threatened" is the lesser-protected of the two categories. Designation as threatened (or endangered) is determined by USFWS as directed by the Endangered Species Act.

Total dissolved solids. Salt, or an aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, and nitrates of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts.

Total maximum daily load (TMDL). An estimate of the total quantity of pollutants (from all sources: point, nonpoint, and natural) that may be allowed into waters without exceeding applicable water quality criteria.

Traditional cultural properties. A property that derives significance from traditional values associated with it by a social or cultural group, such as an Indian tribe or local community. A traditional cultural property may qualify for the National Register of Historic Places if it meets the criteria and criteria exceptions at 36 CFR 60.4 (see National Register Bulletin 38).

Traditional use. Longstanding, socially conveyed, customary patterns of thought, cultural expression, and behavior, such as religious beliefs and practices, social customs, and land or resource uses. Traditions are shared generally within a social and/or cultural group and span generations. Usually traditional uses are reserved rights resulting from treaty and/or agreements with Native American groups.

Trail. A linear route managed for human-power (e.g., hiking or bicycling), stock (e.g., equestrian), or off-highway vehicle forms of transportation or for historical or heritage values. Trails are not generally managed for use by four-wheel drive or high-clearance vehicles.

Transmission. The movement or transfer of electric energy over an interconnected group of lines and associated equipment between points of supply and points at which it is transformed for delivery to consumers, or is delivered to other electric systems. Transmission is considered to end when the energy is transformed for distribution to the consumer.

Transportation linear features. "Linear features" represents the broadest category of physical disturbance (planned and unplanned) on BLM land. Transportation related linear features include engineered roads and trails, as well as user-defined, non-engineered roads and trails created as a result of the public use of BLM land. Linear features may include roads and trails identified for closure or removal as well as those that make up the BLM's defined transportation system.

Transportation system. The sum of the BLM's recognized inventory of linear features (roads, primitive roads, and trails) formally recognized, designated, and approved as part of the BLM's transportation system.

Travel management areas. Polygons or delineated areas where a rational approach has been taken to classify areas open, closed or limited, and have identified and/or designated a network of roads, trails, ways, and other routes

that provide for public access and travel across the planning area. All designated travel routes within travel management areas should have a clearly identified need and purpose as well as clearly defined activity types, modes of travel, and seasons or timeframes for allowable access or other limitations (BLM Handbook H-1601-1 Land Use Planning Handbook).

Trespass. Any unauthorized use of public land.

Tribal interests. Native American or Native Alaskan economic rights such as Indian trust assets, resource uses and access guaranteed by treaty rights, and subsistence uses.

Understory. That portion of a plant community growing underneath the taller plants on the site.

Upland game birds. Non-waterfowl game birds usually hunted with pointing breed, flushing spaniels, and retrievers. Upland game birds include grouse, chukar, quail, snipe, doves, pigeons, ptarmigan, wild turkey.

Utility corridor. Tract of land varying in width forming passageway through which various commodities such as oil, gas, and electricity are transported.

Valid existing rights. Documented, legal rights or interests in the land that allow a person or entity to use said land for a specific purpose and that are still in effect. Such rights include but are not limited to fee title ownership, mineral rights, rights-of-way, easements, permits, and licenses. Such rights may have been reserved, acquired, leased, granted, permitted, or otherwise authorized over time.

Vegetation structure. The stage of plant community development, encompassing age of stand, height of vegetation, and spatial distribution of plants.

Vegetation treatments. Management practices which change the vegetation structure to a different stage of development. Vegetation treatment methods include managed fire, prescribed fire, chemical, mechanical, and seeding.

Vegetation type. A plant community with immediately distinguishable characteristics based upon and named after the apparent dominant plant species.

Vertebrate. An animal having a backbone or spinal column. Includes jawless fishes, bony fishes, sharks and rays, amphibians, reptiles, mammals, and birds.

Viewshed. The panorama from a given viewpoint that encompasses the visual landscape, including everything visible within a 360-degree radius.

Visibility (air quality). A measure of the ability to see and identify objects at different distances.

Visitor day. Twelve visitor hours that may be aggregated by one or more persons in single or multiple visits.

Visitor use. Visitor use of a resource for inspiration, stimulation, solitude, relaxation, education, pleasure, or satisfaction.

Visual resource management (VRM). The inventory and planning actions taken to identify visual resource values and to establish objectives for managing those values, and the management actions taken to achieve the visual resource management objectives.

Visual resource management classes. Define the degree of acceptable visual change within a characteristic landscape. A class is based on the physical and sociological characteristics of any given homogeneous area and serves as a management objective. Categories assigned to public lands are based on scenic quality, sensitivity level, and distance zones. Each class has an objective that prescribes the amount of change allowed in the characteristic landscape (from H-1601-1, BLM Land Use Planning Handbook). The four classes are described below:

- **Class I** provides for natural ecological changes only. This class includes primitive areas, some natural areas, some wild and scenic rivers, and other similar areas where landscape modification activities should be restricted.
- **Class II** areas are those areas where changes in any of the basic elements (form, line, color, or texture) caused by management activity should not be evident in the characteristic landscape.
- **Class III** includes areas where changes in the basic elements (form, line, color, or texture) caused by a management activity may be evident in the characteristic landscape. However, the changes should remain subordinate to the visual strength of the existing character.
- **Class IV** applies to areas where changes may subordinate the original composition and character; however, they should reflect what could be a natural occurrence within the characteristic landscape.

Visual resources. The visible physical features on a landscape, (topography, water, vegetation, animals, structures, and other features) that comprise die scenery of the area.

Visual sensitivity. Visual sensitivity levels are a measure of public concern for scenic quality and existing or proposed visual change.

Waiver. A permanent exemption from a lease stipulation. The stipulation no longer applies anywhere within the leasehold.

Watershed. Topographical region or area delineated by water draining to a particular watercourse or body of water.

Watershed condition indicators. An integrated suite of aquatic, riparian, and hydrologic condition measures that are intended to be used at the watershed scale.

Way. Roadlike feature used by vehicles having four or more wheels but not declared a road by the owner and which receives no maintenance to guarantee regular and continuous use.

Wild and scenic study river. Rivers identified in Section 5 of the Wild and Scenic Rivers Act of 1968 for study as potential additions to the National Wild and Scenic Rivers System. The rivers will be studied under the provisions of Section 4 of the act (BLM Manual 8351, BLM WSR Policy and Program).

Wilderness. A congressionally designated area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, that is protected and managed to preserve its natural conditions and that (1) generally appears to have been affected mainly by the forces of nature, with human imprints substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres or is large enough to make practical its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value. The definition contained in Section 2(c) of the Wilderness Act of 1964 (78 Stat. 891) (H-6310-1, Wilderness Inventory and Study Procedures).

Wilderness characteristics. Wilderness characteristics include size, the appearance of naturalness, outstanding opportunities for solitude, or a primitive and unconfined type of recreation. They may also include ecological, geological, or other features of scientific, educational, scenic, or historical value. Indicators of an area's naturalness include the extent of landscape modifications, the presence of native vegetation communities, and the connectivity of habitats. Outstanding opportunities for solitude or primitive and unconfined types of recreation may be experienced when the sights, sounds, and evidence of other people are rare or infrequent, in locations where visitors can be isolated, alone or secluded from others, where the use of the area is through nonmotorized, nonmechanical means, and where no or minimal developed recreation facilities are encountered.

Wilderness Study Area (WSA). A designation made through the land use planning process of a roadless area found to have wilderness characteristics, as described in Section 2(c) of the Wilderness Act of 1964 (H-6310-1, Wilderness Inventory and Study Procedures).

Wilderness Study Area (WSA) Ways. Existing vehicle routes identified during the BLM's original wilderness inventory; do not include illegal routes created in the interim. The miles of motorized routes in WSAs are only conditionally open to vehicle use. If use and/or non-compliance are found through monitoring efforts to impair the area's suitability for wilderness designation, the BLM would take further action to limit use of the routes or would close them. The continued use of these routes, therefore, is based on user compliance and non-impairment of wilderness values.

Wildland fire. Any non-structure fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire, wildland fire use, and prescribed fire.

Wildland-urban interface (WUI). The line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

Wild river. Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and unpolluted. These represent vestiges of primitive America.

Wild, Scenic, or Recreational river. The term used for what is traditionally shortened to wild and scenic rivers. Designated river segments are classified as wild, scenic, or recreational but cannot overlap (BLM Manual 8351, BLM WSR Policy and Program).

Withdrawal. An action that restricts the use of public land and segregates the land from the operation of some or all of the public land and mineral laws. Withdrawals are also used to transfer jurisdiction of management of public lands to other federal agencies.

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